

ESI Group 2

LoBue #2



FIELD BOOK

FB 802

71280.119

Monitoring
Well
Installation



#3

John Foyes 10/19/93 ①

- 0810 Meet with Layne Western at the ^{South} Chicago Heights municipal water building at 3275 Butler.
- 0830 Arrive onsite. Walk through site with Sonny, Layne's head driller, to determine access to all well locations. Sonny feels access to well locations will not be a problem. Drill crew is decoming rig and equipment.
- 0900 Mobilized to MW07. Layne is setting up over the hole. Miguel Sanchez holds safety meeting.
- 0920 Layne starts drilling.
- 0935 Auger + split spoon refusal due to metal object from 2.5'.
- 0940 Through the metal object.
- 1110 Auger refusal at ~~54'~~ ^{54'} _{10/19/93}
- 1120 Bedrock has been encountered at 54' on MW07. Drillers are now pulling 2 1/4 ID augers and will redrill hole with

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augers to bedrock. —

1130 Miguel leaves site for supplies. —

1145 Break for lunch. —

1315 Return to site from lunch, getting supplies, and calling office. Drillers have started the $\frac{3}{4}$ " ID augers. —

1320 Drillers have just broke the second, red head, auger drive head, due to a piece of concrete approximately 3 feet blgs. Drillers leave site for a welding shop, the third driller stays behind to do some minor work.

Miguel and I recheck the front gate and catch up on ~~sup~~^{sup} our notes.

1410 Drillers return to site. Welding shop could not weld their auger heads because the steel was case hard and would not hold a weld. —

1415 Sonny said one driller will send

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a driller back to their office and well set up over another hole while waiting for the new auger heads. —

1430 Drillers mobilize to decon area.

1515 Layne has mobilized to MW08 after deconing the rig and auger equipment. Layne begins collecting split spoons. —

1535 At approximately 6-7' drillers experience auger refusal, probably a piece of concrete. Sonny, the head driller, is pulling the augers and is going to move the rig forward a few feet. —

1550 Miguel has left site for day. Drillers have moved the rig approximately four feet NE to try again. —

1600 Two young men have just walked by the drill rig with shotguns and would not stop to listen that they should leave

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Photo Log

<u>Photo</u>	<u>Roll</u>	<u>Date</u>	<u>Time</u>	<u>Descp.</u>
1	1	10/19/93	1400	FACING NW. MWOZ - after redhead broke
2	1	10/19/93	1401	FACING W. MWOZ

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the site.

- 1610 Again the drillers have experienced auger refusal at a 6'-7' depth and are going to try moving the rig 5' east.
- 1615 Drillers have lost 5' of auger, center plug, and bit in the hole. They pull their rest of augers and head into town to call their office so the added equipment will be ready when the auger heads are picked up. I also left site to call office.
- 1630 Return to site. The two young men with shotguns are still onsite shooting. A Steger police officer has just pulled someone over in front of the site and I inform him the the two men with guns.
- 1645 A Cook county police officer has just entered the site

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looking for the two men with shotguns. —

1650 Drillers return to the site. Their man who went back to St. Louis will not be back until approx-1300 tomorrow with the needed equipment. Drillers begin packing up their equipment for the night.

1720 Leave site for day. —

1800 At approximately 1700, four to five Cook County squad cars were onsite and they had apprehended the two men with the guns. —

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0700 Miguel Sanchez and John Noyes of Black + Veatch arrive onsite. Drillers are not yet present. The skies are overcast, temps. are in the 50's, chance of rain today. —

0720 Miguel and I look over the location of MW08. We feel the current location may be an old fill area and that is why we keep experiencing auger refusal. We think maybe Layne should try and get their 4-wd rig and place MW08 along the site perimeter. The 4-wd rig is needed due to the area where MW08 is to go is swampy. —

0737 Drillers arrive onsite. —

0750 Miguel, Sammy, and I decide they should ~~start~~^{start} start MW08 next and hold off until ~~the~~^{the} on MW08 until they have a 4wd rig.

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Eric meanwhile is working on making a new auger bit and center plug.

0830 Charged and attempted calibration of O₂A and O₂/LEL. Drillers are still working on a new auger bit and center plug. Miguel and I pick up some equipment from MW08 and then leave site for a phone.

0905 Still have not yet left the site. Drillers were attempting to set up the rig over MW06 when they got stuck. Sonny decided to leave site and call their office for an ATV 4-WD rig. The CME 75 is still stuck by MW06.

0910 Miguel and I leave site to call office.

0930 Call office and spoke with Steve Mrkvicka. Steve said he just got off the phone

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with Brian Biehunko and was pretty much updated with what was going on. I gave a quick summary also. Steve wanted to keep the drillers onsite and busy, and possibly work through the weekend. Steve also mentioned he would like us to go over to roadway trucking and pick up the three empty drums that are there and bring them to this site.

0945 Return to site, drillers are still trying to get the rig unstuck. Sonny, Miguel, and I discuss the possibility of bringing out a bulldozer to create access to every boring location.

1000 Drillers leave site to phone office about this.

1015 Drillers return to site and state they can't do it, Layne would want us to pay for it.

1020 Drillers leave site for phone

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to gain better access to MW06. Miguel and I leave for roadway.

1050 Return to site from roadway trucking with drums. Drillers have also just arrived onsite with their plywood to help them get unstuck.

1145 Drillers finally get their rig unstuck and set the rig over MW07 in anticipation of Pete, the third driller getting back from St. Louis. Again, Sonny, Miguel, and I discuss bringing out a bulldozer to create better access to each well location. I make a point to inform Hayne they will have to pay for the dozer, not Black & Veatch, as stipulated in the contract. Sonny decides to break for lunch and call their field supervisor.

1200 Leave site for lunch and to call office.

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1305 Finished talking to Steve Mrkvicka. Steve felt that we may not want to spread the waste piles around the site which may potentially contaminate the site worse than it already is. His final word was he did not think we should spread around any of the waste piles, we should mention this to the site owner, and he wanted to talk with Dick M. or Scott A. about this. So Miguel and I went back to the site and told the drillers we probably will not be able to use a dozer to gain better access to the well locations. The drillers then left the site to recall their office with this latest information.

1330 Drillers return to site. Sonny said the 4WD ATV rig will not

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be onsite until Monday. They will finish MW07 and then break for the weekend. Also, Pete, their third man was held up in St. Louis until 9AM this morning and probably will not be back until 3PM today. and I

1400 Miguel leave the site while waiting for Layne's equipment man to show up and have the van's oil changed which was low.

1430 Returned to site. Pete, of Layne, is not yet present.

1510 Note, Layne's driller Pete is not yet present and it should be noted that it has started raining pretty hard since 1300.

1600 Leave site to call office. Pete from Layne is not yet present. Steve Mrkucka said not to spread any of the waste piles around and to
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Finish off the well on MW07 before going home on Friday.

1630 Back at the site Pete is not yet present and Sonny feels that we should just call it quits for the day at 1700.

1650 Pete arrives onsite. Layne is checking the equipment and how it works with theirs.

1720 The drill heads brought back by Layne do not fit except for another "red head" which is the type which has been breaking. Sonny has been wanting to try a different type of head that is less likely to break. He says we can start in the morning with the red head but there is a good chance it may break again. Meanwhile he may have one machined to fit or another type sent out
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to the site. If anything comes up he will call me at home tonight. We all leave site for day.

14

14

15k

16c

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(15)

0700 Arrive onsite, drillers not yet present. Skies are clear, temps. in the 50's. I begin calibration of monitoring equipment.

0720 Drillers arrive onsite. Sonny said his office told him he is still probably going to snap the "red head" with the larger ^{5"} augers and they may have to send out a new head. He has to call back to his office at 0800 for more details. In the meantime he will pull the 8 1/4" ID augers to see what's blocking the hole.

0730 I cannot calibrate the OVA. Miguel charged it Tuesday night and I charged it Wednesday night and it will not hold a charge, the pump dies off, also I have no calibration gas for the O₂/LEL and the Valve fitting for the OVA gas bottle broke.

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0745 Sonny and Pete show me that the bottom of the hole is concrete chunks and slabs of iron. Sonny and I discuss the possibility of him rotary wash drilling the first twenty feet of each hole to try and get through the fill without breaking down all the time. It seems this concrete and steel slabs are found as fill all throughout the site. So far MW07 and MW08 have encountered auger refusal at the 5'-7' depth range. After rotary wash drilling the first twenty feet Layne would then switch back to the 8 1/4" ID augers while split spooning to bedrock.

0750 Sonny left to call his office.

0820 Sonny returns to the site. His office told him to try and use the concrete core bit with no center plug, they felt this

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should work. Troy, Layne's office, felt this may work better than a rotary wash method.

0900 Layne has just broke another auger head. Sonny told me another person from Layne is on his way up from St. Louis with more heads but he doesn't know when this guy will get here or what good it will do if he keeps breaking them. Sonny and I discuss our alternatives, he says he thinks a cable tool rig may do the trick. I leave site to call the office as does Sonny.

0910 I explain to Steve Mikucka what has happened, mention the cable tool rig, ^{10/21/93} or possibly using some sort of hydro punch company. Steve said he would like to talk to some people and I should call him back at 1015. I return to site.

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0930 Arrive back at the site. Sonny called his office and they told him they need to talk about their alternatives. Meanwhile the drillers are fixing one two ton truck and picking up around MW07.

1100 Finished talking with Steve Mrkvicka, Scott Anderson, and Miguel Sanchez. The summary of the meeting is ^{5/10/21/93} ~~here~~ Layne is to continue trying to get through the Fill. We need to make several attempts and then just move the location and try again. Also, we will break for the weekend, on Monday we are going to try using 4 1/4" ID augers in hopes of hitting less Fill material. We will pull the augers and then grout in the casing into the open hole.

1130 Drillers have moved the rig
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5' to the east at MW07 to try the hole again. Sonny said they are going to break for lunch and call their office.

1200 Drillers return to site, while Sonny readies the rig the two other drillers decon the 2 1/4" ID augers for exploratory drilling on MW07.

1230 Drillers have mobilized all their equipment (augers + bit + center rod) over to MW07.

1300 Drillers have encountered auger refusal at a 5' depth approx. 5' NE of the original MW07. We have decided to move MW07 to the south side of the guard shack adjacent to the site entrance.

1315 Layne tried getting the rig to the south of the guard shack but could not clear the power lines. I have them move to the opposite side of the site entrance.

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1330 Drillers have encountered auger refusal at 3' below ground surface. Sonny is going to try the rock core bit again on this ~~site~~^{SN 10/21/93} location.

1350 Sonny cannot locate a drivehead big enough to fit over the rock core bit, all three have broke. Sonny decides to try and advance the hole with a smaller diameter auger than the 2 1/4" ID.

1415 Drillers have advanced the hole through the fill to a 10' depth with the 2 1/4" ID augers. I tell them to begin collecting a split spoon now. 0'-10' might have been a waste of time to collect a sample if auger refusal was encountered.

1450 A man arrives from Layne with the new auger heads and is telling the man he needs PVC 6" caps for the 6" PVC well casing.

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1600 Scott Anderson arrived on site just as the drillers hit bedrock at 56.5'. Sonny was going to try and pull the augers and set the 6" casing in the 7" open hole and grout with a 1" tremie. While he pulled his augers I and Scott walked around the site and looked over the other well locations.

1700 Back at MW07 Scott leaves. Sonny has tried setting the 6" casing but some of the hole has collapsed and we would not get a good seal around the bedrock interface so we decided to wait until tomorrow morning and try overdrilling and reaming the hole with the 8 1/4" ID augers.

1730 Leave site for day.

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John J. Noyes 10/22/93

0715 Arrive onsite. Drillers are already present and warming up the rig and setting up for the 8 1/4" ID augers. Temps today are in the high 30's low 40's, skies are clear.

0745 Drillers are having trouble getting the 8 1/4" augers past the 5' depth. They are going to try the rock corer bit.

0810 Attempts up to this point with the larger diameter auger have been unsuccessful. Sonny is going to reream the hole with the 2 1/4" ID augers and the circulate some drilling mud to try and hold the hole open so that we can fill the hole with grout and implace the 6" PVC casing.

0910 Drillers have rereamed the hole with the 2 1/4" ID augers and are preparing some bentonite mud to flush the hole with to try and keep the hole open. —

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John J. Noyes 10/22/93 (23)

0950 Drillers have mudded up the hole and are preparing to pull the augers and drop the grout in.

1040 The pull start rope on the grout pump broke, causing a small delay.

1200 M207 has 6 bags of portland cement in the bottom and the drillers so far have pushed 20' of 6" PVC casing.

1230 We have just broke a second 10' section of 6" PVC casing trying to push to 30'. Sonny feels the hole is just too tight. Sonny leaves sight to call his office and I call my office. I explain the situation to Steve Mrkuvicka. The drillers are down for the weekend. Steve and I discuss the possibility of only putting in three wells instead of four and about moving M205 more east. —

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1445 Leave site for day along
with the drillers.

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John Moyes 10/22/93

John Moyes 10/26/93 (25)

0720 Arrive onsite. Drillers are
present with an ATV.
Present from Layne is Sonny,
Paul, and Shaun. Present
from Black & Veatch are John
Moyes and Ray Suter.
Skies are clear, temps in
the 50's.

0730 Drillers begin decoring the
ATV rig.

0735 I take Ray around the site and
show him all the future well
locations.

0800 Drillers have finished decoring and
are setting up over MW07.

0830 Drillers are still trying to
remove the 6" PVC casing from
the hole.

0845 Drillers have removed the 6" PVC
casing from MW07. There does
not appear any water in the hole. Last
week's grouting could have sealed off
the water bearing zones.

0900 Drillers have started reaming the
hole with 4 1/4" ID augers 7 3/8" OD.

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Sonny and I feel we may still get the 6" PVC casing in the new diameter hole. —

0940 Drillers are still reaming the hole with the 4 1/4" ID augers. —

0945 The engine on the rig is overheated and blowing antifreeze. Sonny said we'll have to break for a while and let the engine cool off. —

0955 Just finished showing Ray the MW08 well location. —

1005 Drillers start the rig backup.

1012 Drillers have reached bedrock. Sonny is going to fill the augers with grout while pulling them out of the hole. The grout at the bottom of the hole will hold the hole open while we cap the bottom of the 6" PVC casing and push it into the hole. The theory is the capped casing will displace the grout around the outside of the casing.

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1055 Two drillers leave site for water while the other driller sets up the grout plant.

1300 Drillers have set and grouted 60' of 6" sch. 80 PVC on MW07. Scott Anderson has arrived onsite to visit. We are all preparing to break for lunch. —

1345 Return to site from lunch.

1405 Drillers left site for water.

1415 Drillers return to site with water and set up to start deconing. Scott Anderson left the site. —

1515 Drillers are deconing equipment.

1540 Drillers have set up over MW08. Ray is setting up our sampling equipment, I am calibrating our monitoring equipment. The O₂/LEL reads 15% O₂ & 50% LEL as required. The OVA read 100ppm and had to be adjusted to read 94ppm.

1600 The bore hole read or pegged

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as high as 800 ppm on the OVA
and 0 ppm on the HNU. Probably
indicating methane or some landfill
gas.

1517 OVA reading on the hole is
1000 ppm, HNU 1 ppm, O₂/LEL
^{100% O₂} 2-4% LEL. Again, probably
methane is being encountered.
Layne has augered 10' already but
has not yet taken a split spoon
due to rubbish and fill creating auger
advancement difficult therefore
would be difficult collecting a
split spoon.

1645 Steve Mrkvicka shows up onsite
to see how things are going. At
the same time the drillers lose
15' of 4'4" ID augers in the hole
for MWOB. Drillers try various
methods to retrieve the augers.

1730 Drillers are welding together
a hook to try and pull out the
augers. The EPA suburban is
stuck in the mud, one driller
is going to try and pull

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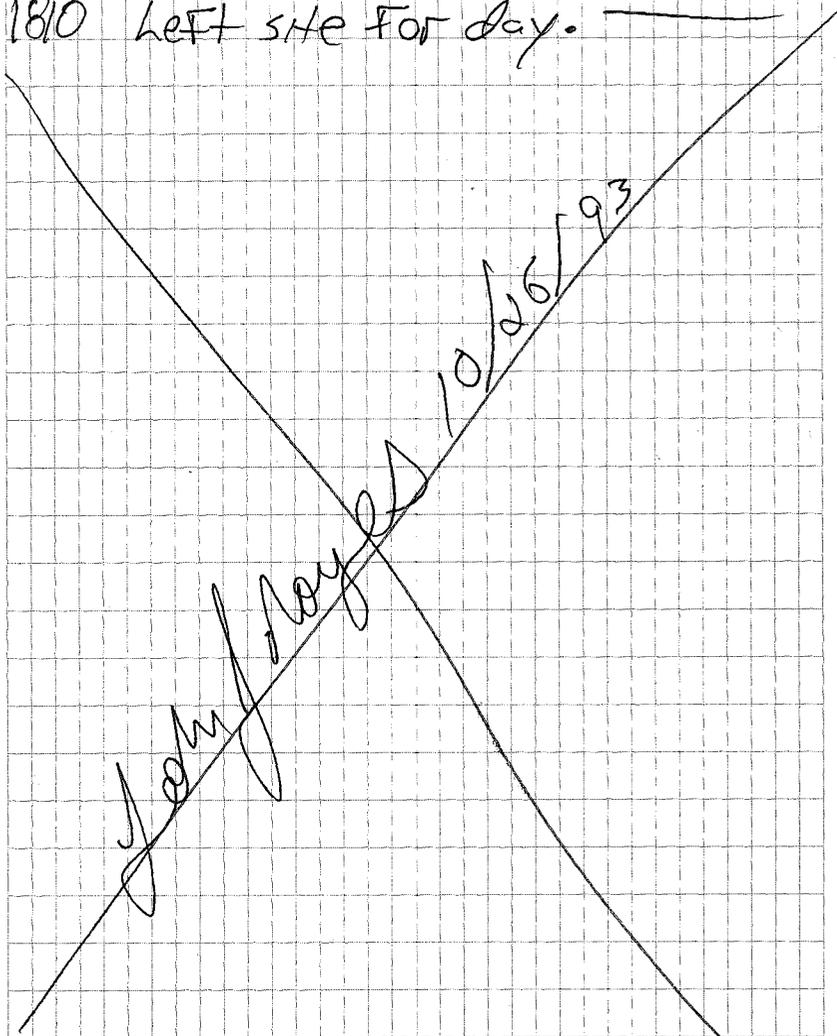
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it out.

1755 Drillers have retrieved the augers
from MWOB.

1810 Left site for day.



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(30) John J. Noyes 10/27/93

0715 Arrive onsite, drillers are present. Skies are overcast temps. in the 40's. —

0800 Ray and I have calibrated the monitoring equipment; the OVA had to be calibrated from 100 ppm to 94 ppm; the O₂/LEH read 15³⁰ O₂/50³⁰ LEL as required; HNU lamp was cleaned and read 54 ppm as required. Our work station is set up and drillers are tripping in the 15' of augers we lost yesterday. —

0830 Checked the borehole; OVA read 100 ppm, HNU 0 ppm. Drillers are collecting a split spoon from 20'-22'. —

0910 Checked the borehole; OVA read 1000 ppm; HNU 0 ppm. Drillers just collected a split spoon from 30'-32'. —

0945 Two men in a blue pick up were just spotted by me leaving this site. The truck

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looked the same color as a scrap man who has been coming on site all last week to try and pick through scrap iron onsite. Last week I told him no, he could not have any iron onsite, it's not mine to give.

0950 Checked the borehole, OVA reads 1000 ppm, HNU reads 0 ppm. Drillers are at a 40' depth.

1050 Drillers have encountered auger refusal at approximately 55' below ground surface. —

1150 Correction to last entry, drillers are currently attempting to obtain a split spoon from 60'-62'. Bedrock has not yet been encountered.

1230 The split spoon from 60'-62' was a highly weathered lime green limestone which resembled shale. We still have not hit solid rock at 65'. Sonny is adding on his last 5' of 4 1/4" ID auger. —

1315 Auger refusal at approximately 66', Sonny takes a split spoon.

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and is only able to advance
4 4". Bedrock is at approximately
66.6' below ground surface.

1340 Left site for lunch. —

1435 Return to site from lunch,
drillers are already back
and on the drill rig. —

1440 Two drillers left to get water.
Sonny said he will mix up some
drilling mud to help keep
the hole open after we pull
the augers and while we
grout the hole and push
the casing in. —

1530 Drillers have flushed the hole
with bentonite mud and are now
filling the augers with grout.

1610 Drillers are still pulling augers
and grouting the hole for
the 6" PVC casing. —

1655 The drillers have pushed 57'
of 6" PVC casing into the
hole before refusal was encountered.
The hole is 66' deep. The refusal
of the casing is probably due

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to a bit of hole collapse,
sonny and I decide to push
out the bottom of the casing
(cap) and push the casing
the rest of the way to
rock without the bottom
capped. Sonny will then
grout the outside of the
casing with the 1" tremie.

1730 Drillers are working on getting
the casing pushed to bedrock.
The cap at the end of the
6" PVC casing has been punched
out. —

1750 Sonny has been able to only push
61' of casing into the hole, if
he pushes any harder we stand
the chance of snapping the
casing. I told sonny that this
depth is fine, the weathered
limestone is very much like a
clayey shale and will act as
an aquitard, we have the casing
at least 2' to 3' into the weathered
lime with plenty of grout. Ray

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and I feel this setup as it is now should prevent any cross contamination. Drillers meanwhile are deconing some equipment.

0605 Leave site for day.

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(35)

0700 Arrive onsite. Drillers not yet present. Skies are partly cloudy, temps. in 40's.

0724 Drillers arrive onsite. Sonny said today they will finish grouting in the 6" PVC on MW08, and the decon all their equipment and hopefully get set up over MW05.

0823 Drillers are picking up their equipment, breaking down the rig, and mixing grout.

0840 Drillers have grouted in the rest of MW08 and are working on mobilizing all equipment to the decon pad. Ray and I leave the site to find a place to dispose of all investigatio derived waste (IDW).

0930 Return to site from disposing of IDW. IDW was disposed of at the South Chicago Heights Department of Public Works.

Permission was granted to dispose
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of our IDW in their dumpster by an employee of the South Chicago Heights Public Works, name was not obtained. Layne is deconing equipment.

0940 Ray and I walk to the location of MW05 with Sonny. Sonny feels he shouldn't have any trouble getting the rig into the ditch along the northern edge of the site, he will have to cut a few small trees. The proposed location for MW05 is in the ditch along the north central edge of the site. Also, I told Sonny that before we set the well we need a submersible pump to pump out the hole and check for reactivity to see if we have encountered water. Also, I told Sonny they can not use the air lift method to develop the

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wells. They need to surge back the well and the pump it out. This should be done several times. Sonny said he is going to call his office with a list of equipment to inform them ahead of time what we will need.

1040 Sonny is now mobilizing the drill rig to the MW05 proposed location.

1045 Ray begins calibrating monitoring equipment. The H₂O reads 54 ppm as required. The O₂/LEL reads LEL 55% as allowable and O₂ 15.5% as required. The OVA had to be adjusted from 100 ppm to 94 ppm.

1145 Drillers are experiencing difficulty moving the rig into position in the ditch along the north central side of the site. A few small trees (6" in diameter) have had to be pulled, drillers are backing

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the rig out and are trying from another direction. —

1150 The rig is now stuck in wet clay in the ditch. —

1220 Break for lunch. Sonny and I decide to set the rig over MW06 and hold off on MW05. Reason being we are experiencing a lot of trouble setting the rig over MW05 to set the 6" PVC casing. After setting the casing we would just have to pull off the hole and move to MW06. We may not get the rig back over MW05 well enough to set the well at a later date. Therefore, when Layne has all the equipment with them next week they will set up over MW05, set the casing and the well before pulling off the hole. —

1335 Returned to site from lunch and calling office, left an update on Scott Anderson's voice
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mail. Drillers are now moving the rig to MW06. —

1405 Sonny starts augering on MW06. —

1415 Drillers have augered to 5', we checked the borehole: OVA read 100 ppm, HNU 0 ppm. —

1445 Checked the borehole; OVA read 60 ppm, HNU read 0 ppm. —

1510 Checked the borehole, the hole smelled like a sewer; the OVA would peg at 1000 ppm and flame out, HNU read 0 ppm, the Parallel read 100% LEL in the borehole + ~~0.18~~^{5.4} 5% O₂ in the borehole; the breathing zone read 22% oxygen + 0-2% LEL. —

1520 Checked the hole again, the hole reads 80% LEL the work zone and breathing zone reads 0% LEL, Health & Safety Plan says 5-10% LEL in work zone source should be eliminated. —

1530 We think we might have hydrogen sulfide (H₂S), gas emanating

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From the borehole. I call Scott Anderson, consult the HSP and tell the drillers to shutdown and back off.

1550 Scott & the HSP said to try and eliminate the source vent the hole, and constantly monitor the breathing zone, if the breathing zone constantly reads above 5 ppm we should evacuate and go to level B.

The wind is blowing from west to east and is blowing the gas under the rig and away from us.

1600 Sonny lifted the head off the augers to try and vent the hole. We plan to try and mud the hole and eliminate the source of H₂S.

1615 We no longer smell the rotten eggs, near the controls on the rig the OVA reads 4-20 ppm, the O₂/LEL reads O₂ 22% & 0% LEL in the breathing zone. In the

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borehole the O₂/LEL reads 20% O₂ and 20-40% LEL. 1630 Sonny pulls the center plug from the augers. The readings in the borehole are: OVA 100 ppm; O₂ 22%, LEL 0-2%. The readings in the breathing zone are: OVA 0-100 ppm; O₂ 22%, LEL 0%. Sonny is going to spin the augers again to see if we are on rock.

1645 Have advanced the borehole another 5'. The drillers are going to take a split spoon. Ray has been monitoring the breathing zone constantly with the O₂/LEL and receiving zero readings.

1715 Drillers are stopping for the day. I called the office at 1700 to inform Scott I think the H₂S hazard may be over, and that we would like an H₂S monitor. Scott said if we need to we'll order one from HAZCO. He gave me Bal's number to call tonight.

John J. Reyes 10/28/93

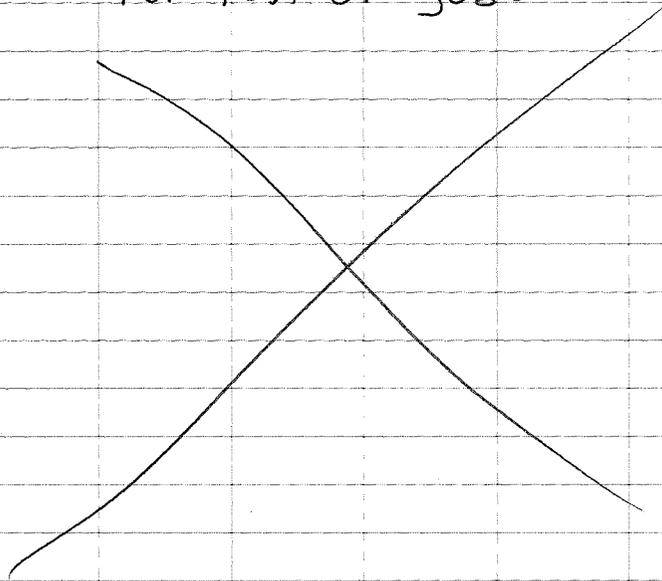
(42)

John Meyer 10/28/93

The drillers feel we are on rock at a 30' depth. A split spoon would not advance. Sonny said in the morning he will try to roller bit approx. two feet to be sure we are on rock and not a boulder. Ray and I begin to clean up.

1740 Leave site for day.

1745 Give logbook to Ray Sitera for rest of job.



John Meyer 10/28/93

Ray Sitera 10/29/93 (43)

- 0700 Arrive on site ^{MW06}. Drillers not here yet. Sky is cloudy, cold, windy. Temp in 30's.
- 0715 Drillers arrive. Sonny suggests coring rock at MW06 - best to get samples to determine if rock encountered is a glacial erratic or bedrock.
- 0720 Drillers loading decon equipment into truck, hitching sprayer trailer.
- 0750 Moving to MW06, 2-ton flatbed stuck in mud, using winch from drilling rig to pull it out.
- 0755 Calibrating air monitoring equipment: O₂/LEL reads, O₂ - 15.2% as allowable, LEL - 55% as allowable. H₂N reads 54 ppm as required. OVA adjusted from 100 ppm to 94 ppm.
- 0820 O₂/LEL, H₂N + OVA readings all OK at borehole + in breathing zone; no odor.
- 0825 Drillers pulling up rod at MW06 to prepare for coring.

Ray Sitera 10/29/93

(44)

Ray Antara 10/29/93

- 0840 Coring tool is 3" O.D., $1\frac{3}{8}$ " I.D.
- 0855 Coring begun at 30'. —————
- 0920 Coring retrieved, only about 4".
Rock is a gray dolomite with patches of black organic material. Not at all similar to the bedrock previously encountered at MW07 & MW08. Must be a glacial erratic. Will continue to core. Drillers leave to get water - water lost into formation. —————
- 0925 2-ton flatbed stuck in mud.
- 0930 O₂/LEL, H₂N + OVA readings all at acceptable levels, no odor. —————
- 0945 Leave drillers on site to make phonecall to office. —————
- 1015 Back on site. Drillers still freeing 2-ton. —————
- 1030 2-ton finally free. Drillers leave for water. —————
- 1110 Drillers ready to begin coring again. —————
- 1130 Coring advanced to approx. 33.5', or 3.5' into the rock encountered at 30'. —————

Ray Antara 10/29/93

Ray Antara 10/29/93

(45)

- 1140 Sample retrieved from corer. Approx. 2' retrieved. —————
- 1150 O₂/LEL, H₂N + OVA readings all at acceptable levels, no odor. —————
- 1200 Breaking for lunch but 2-ton is stuck in mud again. Drillers using semi to pull it out. —————
- 1220 Truck pulled out of mud. Break for lunch & drillers get water for grout. Decided that rock found at 30' in MW06 is bedrock, but of a different type. Contact between MW07 & MW06. Appears to be Niagara Dolomite (Silurian). All is consistent with geology of northern Illinois. —————
- 1325 Back from lunch. Drillers already back. 2-ton stuck in mud again. —————
- 1335 2-ton out of mud. Drillers back to MW06 to pull up drilling rods & augers. Sunny suggests it will be easier at this hole to pull the auger & then tremie in the grout. Should be no problem since no sand found here to heave into hole after augers are

Ray Antara 10/29/93

(46)

Ray Antera 10/29/93

pulled.

1345 Drillers don't want to chance getting vehicle stuck in mud so they are carrying grout to hole by bucket (~150 ft.). Grout added before augers come up.

1400 Augers coming up.

1420 Augers up, drillers filling the rest of the hole with grout.

1440 PVC casing goes in.

1500 Only 25' of PVC casing can be pushed in hole - 6 ft. to go.

Options are: use carbon steel in place of PVC, or let it set until other walls are done & core through grout but how good a seal?

1510 Decide to break for weekend. Will call office to find out what to do.

1535 Decon augers, get things ready to leave.

1630 Leave site for the day.

Ray Antera 10/29/93

Ray Antera 11/1/93

(47)

1230 Arrive on site. Drillers not present except for Shaun. He has moved the rig to the central area & has repaired an oil leak to the right rear hydraulic jack. Attempted to decon. but ran out of water. Will have to wait for the others. Temp. in 40's, sunny, slight breeze.

1245 Leave Shaun on site to make some phone calls & gas up truck.

1310 Back on site. Drillers still not present. Results of conversation with myself, Scott Anderson, John Chitwood & Rick Brinker, re: what to do about mwob (conducted at office this morning): All agreed that best course is to core into grout when dry & insert 2" I.D. PVC pipe through grout after coring to desired depth in bedrock. All agreed that weak point would be where grout contacts bedrock.

Ray Antera 11/1/93

(48)

Ray Antera 11/1/93

along the sides of the borehole. But this condition exists with either option (see 1500, 10/29/93). Therefore go with coring through grout as quickest + cheapest way. This leaves 5 feet of uncased well between bottom of casing and bedrock, but should be OK since its in clay (no sand layer in this hole).

- 1340 Drillers still not present. —
 1410 Drillers still not present, except for Shaun. —
 1425 Drillers arrive: Sonny + Pete.
 1435 Pete + Shaun leave site for water. —
 1445 Pete + Shaun return. Fill tanks on rig w/water. —
 1510 Pete + Shaun leave for more water ⁽¹⁹⁾ to decon rig + augers from Friday's drilling. —
 1520 Calibrating air monitoring equipment:
 O₂/LEL/H₂S: O₂ @ 15.2 = acceptable
 LEL @ 54 = acceptable

Ray Antera 11/1/93

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- H₂S @ 10 ppm - acceptable
 H₂N : 54 ppm - acceptable
 OVA : Can't calibrate, methane too low in cylinder. —
 1525 Drillers deconing. —
 1605 Drillers finished deconing. Sonny moving rig to MW05. —
 1625 Rig overheats moving to MW05 + alternator is suspected by drillers of being bad. Drillers taking out alternator for testing at service station tonight. Will let rig cool down + try to move it to morning. —
 1655 Leave site for the day. —

Ray Antera 11/1/93

(50)

Ray Suter 11/2/93

0700

Arrive on site. ^{MW05} No drillers present.
Temp. in 40's, cloudy, breezy.

0715

Calibrate air monitoring instruments.

O₂/LEL/H₂S:

O₂ - 15.4 acceptable

LEL - 53 acceptable

H₂S - 10 ppm acceptable

H₂N₂: 54 ppm - acceptable

OVA: can't calibrate, no methane.

0720

Drillers arrive. Sonny says they found a place to get the alternator fixed last night but it's not open until 0800 so we'll have to wait. Shaun not on site yet.

0740

Sonny + Pete leave site to pick up alternator.

0750

Shaun arrives.

0800

Sonny + Pete return w/ alternator.

Service station said that alternator is OK, must be regulator. Shaun installs alternator while Sonny + Pete take regulator for replacement.

0905

Sonny + Pete not yet back on site.

0935

Sonny + Pete not yet back

Ray Suter 11/2/93

Ray Suter 11/2/93

(51)

on site.

0945

Correction to previous entries concerning having no methane to calibrate OVA: Extra cylinder of methane (100 ppm) found in box in vehicle. OVA now calibrated to 100 ppm methane.

0950

Sonny + Pete not yet back on site.

1020

Sonny + Pete back on site.

1050

New regulator on rig, rig set in place, ready to start augering.

1055

Before augering: OVA - 0 ppm

H₂N₂ - 0 ppm

% LEL - 0

H₂S - 0 ppm

% O₂ - 20.8

1100

MW05 will be placed in drainage ditch at north end of site at highest point ATV can reach, about 15' west of north-south line through power line pole.

1105

Start augering.

1120

All air monitoring at acceptable levels.

Ray Suter 11/2/93

(52)

Ray Autera 11/2/93

- 1200 Air monitoring at acceptable levels.
 1220 Air monitoring at acceptable levels.
 1245 Break for lunch.
 1350 Back from lunch, start drilling.
 1355 Air monitoring equipment at acceptable levels.
 1420 Hit bedrock at ~40' - auger refusal.
 1435 Pete + Shaun leave for water to grout + decon.
 1520 Grouting begins.
 1615 Grouting + decon of augers done.
 1630 Leave site for the day. 6" ID. PVC casing set to bedrock + grouted to surface.

Ray Autera 11/2/93

Ray Autera 11/3/93

(53)

- 0700 Arrive on site ^{my 05}. Drillers, Sonny + Pete arrive, Shaun has car trouble, not here yet.
 0705 Scott Anderson arrives with questions about billing + what has been done so far. Drillers getting set up. 5 $\frac{3}{4}$ " tri-cone to be delivered today. Temp. in 40's, partly cloudy, breezy.
 0800 Calibrate air monitoring equipment:
 O₂/LEC/H₂S meter: O₂ at 15.3 as acceptable, LEC at 53 as acceptable, H₂S at 10 ppm as acceptable.
 HNu meter: 54 ppm as acceptable.
 OVA: calibrated to 100 ppm methane.
 0915 Sonny + Pete placing drilling rod w/ 3 $\frac{7}{8}$ " diamond bit into casing. Air monitoring levels before coring:
 O₂ - 20.8%, LEC - 0%, H₂S - 0 ppm, HNu - 0 ppm, OVA - 0 ppm.
 0930 Coring begins. Shaun arrives.
 0955 Air monitoring at acceptable levels.
 1010 Coring stops due to oil leak on rig + arrival of equipment from Layne.

Ray Autera 11/3/93

(54)

Ray Autera 11/3/93

- Leak is from main hydraulic line in front of rig where it connects to hydraulic tank. Sonny says we'll be down for a while.
- 1215 Break for lunch & repairs. Shaun to take broken hydraulic hose to Layne's Joliet facility for repair. Sonny & Pete to find a replacement seal for a second leak. Only about 2 1/2 feet cored to this point.
- 1400 Sonny & Pete return. Still waiting for Shaun with hose.
- 1415 Shaun returns w/hose. Drillers suiting up for repairs.
- 1500 Hose is repaired on rig, as is seal on rotary unit. Coring resumes.
- 1545 Coring going very slow: bedrock is hard & bit is dull. New bit should arrive tomorrow. Cored only 2 1/2 feet in ~ 35 minutes.
- 1630 Coring rods coming up to check out bit & catcher to see why such a small recovery.
- 1700 Too dark to continue, get set to break for the day.

Ray Autera 11/3/93

Ray Autera 11/4/93

(55)

- 0700 Arrive on site. ^{MWOS} Sonny & Pete already here. Temp. in 40's, partly cloudy, windy.
- 0720 Sonny & Pete attempt to clean out coring bit which is full of soft material from a soft seal in the bedrock. That's probably why there was such a small recovery from yesterday's core attempt.
- 0730 Calibrating air monitoring equipment:
O₂/LEL/H₂S: O₂ at 15.3, LEL at 54, H₂S at 10 ppm, all acceptable.
H₂N at 54 ppm & OVA at 100 ppm methane, all acceptable.
- 0740 OVA behaving erratically. Needle fluctuates wildly on all scales, even far away & upwind of site. H₂N & O₂/LEL/H₂S meters show nothing in air at the site. OVA is turned off at 0745. Will go with just H₂N & O₂/LEL/H₂S meters.
- 0750 Sonny says coring bit is shot, no longer useful. He has gone to find a phone to see when the replacement will arrive.

Ray Autera 11/4/93

(56)

Ray Antea 11/4/93

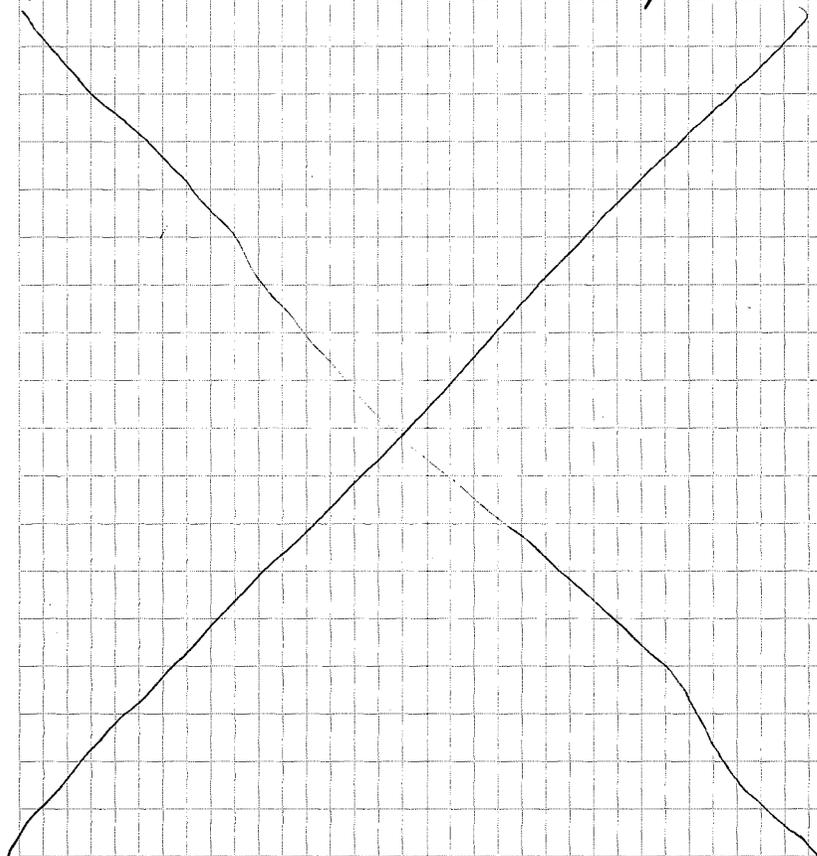
- 0830 Sonny says replacement coring bit should arrive at their motel at about 1000. He'll try to use this one + see if there are any results. _____
- 0850 Air monitoring levels before coring:
 O_2 - 20.8%, LEL - 0%, H₂S -
~~0.1~~^{ppm} H₂ - 0ppm. _____
- 0940 Coring begins. Air monitoring at acceptable levels. _____
- 0955 Borehole losing drilling water quickly. Bedrock must be fractured. _____
- 1010 Air monitoring at acceptable levels.
- 1015 Shawn arrives w/ more hydraulic oil.
- 1040 Air monitoring at acceptable levels. Core comes up. Only 8"-10" run. Chert in bedrock too hard for a dull bit. _____
- 1130 Break for lunch + drillers drive back to motel to pick up bit. _____
- 1220 Back from lunch. Drillers arrive w/ water + new bit. _____
- 1250 Bit replaced, ready to start coring. _____
- 1405 Coring continuing steadily but still

Ray Antea 11/4/93

(57)

Ray Antea 11/4/93

- slowly.
 1455 Coring rate ~ 3ft/hr.
 1500 Air monitoring at acceptable levels.
 1550 Air monitoring at acceptable levels.
 1630 Air monitoring at acceptable levels. Still coring MW5.
 1700 Leave site for the day.



Ray Antea 11/4/93

(58)

Ray Suter 11/5/93

- 0700 Arrive on site for work on MW05.
Drillers arrive. Temp. in 40s,
cloudy, windy.
- 0715 Calibrate air monitoring equip-
ment: O₂/LEL/H₂S meter:
O₂ at 15.2, LEL at 52, H₂S
at 10 ppm, all as required.
H₂Nu: 54 ppm as required.
- 0720 Coring begins on MW 05.
Air monitoring levels before corings:
O₂ - 20.8%, LEL - 0%, H₂S - 0 ppm,
H₂Nu - 0 ppm.
- 0810 Air monitoring at acceptable levels.
- 0850 Cored to 60'. That's 20' into
bedrock. Borehole will now be
pumped to determine if there is any
recovery. If there is, we have reached
bedrock G.W. & well will be set. First
Sonny has to go back to motel for
pump controller unit. Coring equipment
coming up.
- 0855 Air monitoring at acceptable levels.
- 0915 Break for drillers to get pump controller
& some hydraulic oil. Sonny says 1 to
1 hr. 15 min.

Ray Suter 11/5/93

Ray Suter 11/5/93

(59)

- 1200 Drillers arrive w/ pump controller
& hydraulic oil.
- 1210 After sitting for ~ 3 hrs., water
level is 45.2 ft. from top of eductor
pipe.
- 1220 Drillers can't get pump ^{down} past bedrock/
overburden interface even though core
I.D. \approx 3" & pump O.D. \approx 1 $\frac{3}{4}$ ".
- 1245 Drillers using drill rod to locate hole at
bedrock surface & see if there are any
obstructions.
- 1255 Drill rod goes into hole OK, try again
with pump.
- 1300 Air monitoring at acceptable levels.
- 1315 Well being pumped at \approx ~~25~~ 5 gpm. Pump
at \approx 52 ft. Water is not muddy \therefore
a good seal outside the 6" PVC.
- 1330 After 15 min. of pumping at 5 gpm,
drawdown is only .4 ft. \therefore well is
recharging & is set deep enough.
- 1340 Drillers can't pull up pump from bore-
hole, must be caught on something.
- 1350 I leave to get something to eat.
Drillers still working on retrieving pump.
- 1420 Back on site. Sonny & Pete have

Ray Suter 11/5/93

(60)

Ray Auten 11/5/93

gone to a phone to call their office about freeing the pump + whether or not they can force it up.

1500 Sonny + Pete return. Back to work attempting to free pump.

1525 Pump is still in hole. Drillers have tried slipping 2" I.D. well pipe over PVC discharge pipe attached to pump + running it down to level of pump + rotating it to free whatever is blocking the pump - not successful. Are currently trying same with 3" O.D. coring rod. Drillers had to cut wires to pump in order to slip pipe over the discharge pipe as it was connected to a spool on the other end.

1645 Drillers could not extract pump from borehole as the PVC discharge line broke off at the pump outlet. PVC is up. Try again tomorrow.

Ray Auten 11/5/93

Ray Auten 11/6/93

(61)

0700 Arrive on site for work on MW05. Drillers not present. Temp. in low 30's, partly sunny, breezy.

0715 Sonny + Pete arrive. Get set to try to extract pump again.

0755 Shaun arrives.

0840 Drillers' attempt to slip NW coring rod over pump + pull it up fails. Pump is now probably at bottom of ~~well~~ borehole. Called Scott Anderson to report but not home. Likely options at this point are: ① grout in entire borehole w/ pump in it + start a new one a few feet away, ② grout the pump in to the bottom of this borehole + insert well casing above it. This would still leave enough room in borehole for a good bentonite seal at the bedrock/overburden interface (we need at least 17' ~ 20' deep now, pump length ~ 1.5'). Questions: ① Is it acceptable to leave the pump in the borehole? ② Who will pick up the cost of the lost pump + possibly the extra augering + tri-soning?

Ray Auten 11/6/93

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Ray Suter 11/6/93

- 0900 Drillers leave to call office for advice on what to do. One last possibility for retrieving the pump is to get (from Layne's Joliet office) a soft metal that can be heated & softened & inserted into the bottom of NW casing rod & lowered into the borehole & onto the pump & then allowed to harden & fuse to the pump & then be brought up as one solid piece of metal. Another possibility is to find a tool that can hook onto the pump & withdraw it.
- 1030 All are back on site. Sonny called office & spoke to Brian & Paul. Layne's decision is to do what it takes to get the pump. Drillers have some ideas. Could take quite a while.
- 1145 Drillers have retrieved top portion of the pump which includes the screen. Bottom part which includes motor is still in hole (approx. 8'-9" long). Drillers attempt retrieve the rest.
- 1245 Drillers have retrieved most of

Ray Suter 11/6/93

(63)

Ray Suter 11/6/93

- the pump. What little is left is smashed at the bottom of the borehole. Next step will be to tri-cone the hole. If the few remaining pump parts do not come up with the cuttings, we will isolate them at the bottom of the borehole with bentonite (a few inches).
- 1255 Break for lunch & for drillers to get water for tri-coning.
- 1405 All are back on site. Prepare for tri-coning (reaming) the borehole to 4".
- 1445 Tri-coning begins.
- 1500 Tri-coning rate ~ $\frac{1}{2}$ ft/min., max. but variable.
- 1600 Sonny says they are unable to get the cuttings out of the hole using just water even when ground fine. Will talk to Scott about using mud or filtered air to remove cuttings.
- 1700 Leave site for the day.

Ray Suter 11/6/93

(64)

Ray Antea 11/7/93

- 0700 Arrive at site for work on MW05. Drillers not present. Temp. in 20's, sunny, breezy. Talked to Scott Anderson, Steve Mrkwicka, Rick Brinker & John Chitwood last night about using drilling mud to bring up the cuttings & what's left of the pump in MW05. All agree, if mud is the only way, we'll have to go with it. Must be sure to flush the borehole afterward w/ clean water until clear. If pump pieces don't come up we should tri-cone a little deeper to maybe get underneath it & then maybe it will come up. If all else fails, then smash it to the bottom & seal it down there w/ a few inches of bentonite to isolate it from well, but this is a last resort. Note: drillers are using 5 $\frac{3}{8}$ " tri-cone, not 4".
- 0715 Sonny & Pete arrive. Shaun will be here about 0800.
- 0730 Sonny & Pete start tri-coning w/ bentonite mud as the drilling fluid.

Ray Antea 11/7/93

Ray Antea 11/7/93

(65)

- 0900 Drillers still can't get enough cuttings out of the well to lower the drill rod enough to put on another 5' section of drill rod. Have to wait for Shaun with cable tool bailer.
- 0920 Pete goes for more water.
- 1030 Sonny has managed to get some cuttings out of the borehole by thickening up the mud. Has been able to put on another section of drill rod & has resumed tri-coning.
- 1045 Pete returns w/ water.
- 1110 Shaun arrives w/ cable tool bailer. Tri-coning continues.
- 1210 Tri-coning finished. Depth 61' which gives us 21' below bedrock/overburden interface. Drill rod coming up.
- 1300 Break for lunch.
- 1400 Back on site. Drillers prepare to bail cuttings from borehole w/ cable tool bailer.
- 1410 Bailing cuttings from borehole.
- 1505 Flushing borehole w/ potable water. Approx. 200 gal. used. Water is fairly clear, just some suspended material left.

Ray Antea 11/7/93

(66)

Ray Antares 11/7/93

- 1515 Specs. call for cap on bottom of screen to have 10 .01" holes drilled in it. Smallest drill bit the drillers have is $\frac{1}{4}$ " so they will put in 5. 3" of bentonite chips are placed at the bottom of the well to isolate any pump parts left in the borehole. Centralizers placed at 2' below top of screen + at 10' above that point. 6" sump below well bottom.
- 1545 Bottom of well set at 60.0'. Drillers adding sand slowly
- 1630 Sand placed from bottom of borehole to 2' above screen, ~~etc.~~¹⁰ depth 48'.
- 1650 Leave site for the day.

Ray Antares 11/7/93

Ray Antares 11/8/93

(67)

- 0700 Arrive on site to finish work on MW05. Drillers not present. Temp. in 30's, cloudy, breezy.
- 0715 Sonny + Pete arrive, prepare to start work + get water.
- 0730 Shaun arrives.
- 0745 Pete + Shaun go for water, Sonny sets up.
- 0800 Pete + Shaun back w/ water.
- 0900 Bentonite slurry being mixed. Since high solids bentonite is not available, a very thick mixture of pure bentonite is being used for the seal. Brand is Wyo-BEN pure bentonite powder. Mixture used is 25lb of bentonite + 15 gal. of water - very thick.
- 0915 Bentonite slurry being pump down bore hole. Correction to 11/7/93, 1630: Sand is 3' above screen, depth 47'.
- 0945 Bentonite is in annulus between 6" + 2" PVC pipes. Entire batch used. Sonny says the slurry is firm at 40' 2", but this doesn't include the softer stuff above which the weight on the tape sinks right through. Hard to tell where the

Ray Antares

(68)

Ray Suter 11/8/93

real top of the bentonite is because there is clear water above the bentonite that washes the bentonite off the tape on the way up. They don't have a pump right now that can pump that off. Volume calculations show that bentonite should be well above bedrock/overburden interface, so we'll go with it. I'm confident about this seal.

Field calculation: 6" I.D. volume 1.47 gal/ft.

2" I.D. volume ~ .2 gal/ft.

Annulus: 6" volume - 2" volume

= 1.47 gal/ft - .2 gal/ft

= 1.27 gal/ft

Assuming bentonite slurry to be ~17 gal,
minimum (15 gal. H₂O + 25 lb. bent.),

this should occupy an annular
height of 17 gal / 1.27 gal/ft = 13.4 ft.

This is well above the bedrock/
overburden interface (~40') and
should be at above 32' deep.

1005 Cement/bentonite grout has been
mixed + is now being pumped. Mixture
is ~ 90% cement, 10% bentonite.

Ray Suter 11/8/93

Ray Suter 11/8/93

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1020 Annulus grouted to surface. Sonny digs
hole for concrete pad.

1130 Correction: Seal at top of gear
housing at base of vertical drive line
at back of rig has not yet been
replaced. Sonny has bought one but
has not put it on - still leaking.

Correction: Layne does not have a
Joliet office, it is in Aurora. This
is where Shawn works + where repairs
were done + where some equipment has
come from.

1205 Break for lunch.

1300 Back from lunch. Continuing work on
concrete pad + well protector casing.

1430 Well protector + guardposts in place,
preparing to cement them in + build the
pad.

1600 Brian Biahunko from Layne arrives
w/ replacement pump.

1620 Plan is to pump well to remove intro-
duced water, but Sonny left contro-
ler box in motel room.

1630 Prepare to leave; clean up.

1700 Leave site for the day

Ray Suter 11/8/93

⑦⑩ Ray Suter 11/9/93

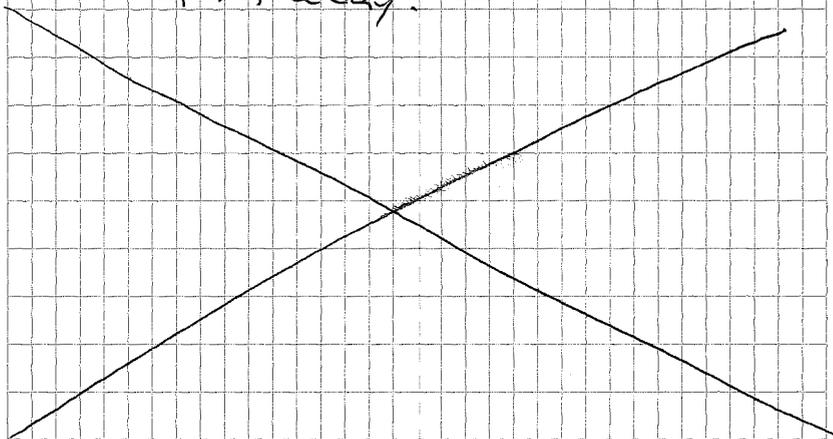
- 0700 Arrive on site to finish work on MW05.
Sonny + Pete on site. Temp in 40's,
sunny, slight breeze.
- 0730 Shaun arrives. Set up submersible
pump to pump off all water
used in drilling.
- 0745 Water level is 41.5' from TOC.
- 0800 Rig is now out of drainage ditch.
Water being pumped from MW05 at
13.5 gpm.
- 0900 Maintain pumping at 3.5 gpm. Water is
very clear but has an organic odor.
- 0910 Drillers will hand-wash coring rod
before moving to next borehole. This
is because the steam sprayer is not
operational. We will sacrifice steam
cleaning the back of the rig, other-
wise we would have to break + end
the week early as the unit has to be
brought back to St. Louis to be re-
paired. This is justifiable considering
how much water is being used in coring
+ tri-coring.
- 0940 Odor coming from pumped water is ac-
tually sulfur, which is common to the

Ray Suter 11/9/93

Ray Suter 11/9/93

⑦⑪

- bedrock wells in the region.
- 1000 Rig is set up over MW07 for coring
bedrock.
- 1050 After 20 min. repair on rig's driveshaft,
eductor pipe goes in.
- 1100 Coring rod goes in. Depth ~ 54'
- 1145 Pete, Shaun + myself go to lunch. Sonny
stays on site.
- 1240 Back on site, ready to start coring.
- 1305 Pump on MW05 was stopped at about
1200. That's 3 hours at 3-4 gpm for
about 650 gallons pumped which is about
what was put in.
- 1500 Coring rate is about 6.5 ft/hr, MW07
- 1700 Cored to ~ 69'. Leave site
for the day.



Ray Suter 11/10/93

(72)

Ray Suter 11/10/93

- 0700 Arrive on site for work on MW07.
Sonny + Pete present.
- 0715 Shawn arrives on site.
- 0800 Correction to 11/9/93, 1700. Sonny has pulled up the coring rod in MW07 & says that he used 77' of rod w/a 4" stick up which equals 73' for the borehole. That gives us $73 - 55.5 = 17.5'$ into bedrock which gives us plenty of room for a good seal at the bedrock/overburden interface. The next step will be to tri-cone to 73', then place the 2" PVC in the hole. This will be done prior to pumping the borehole to test for groundwater in the bedrock so that we can safeguard against losing another pump in the borehole. If we have water, we'll set the well. If we don't have water we'll need to pull up the PVC & drill some more.
- 0815 Drilling mud being used to bring up cuttings. Coring begins, 5 $\frac{7}{8}$ " tri-cone.
- 0845 ~~Core~~ ^(P) barrel Drilling ^{bit} clogged, need to pull it up for cleaning but can't break rod. Using torch.

Ray Suter 11/10/93

Ray Suter 11/10/93

(73)

- 0855 Pulled up rod 5', bit is unplugged. Continue tri-coning.
- 1215 Finished tri-coning. Depth to bottom - 73'. Pumping off drilling mud until clear.
- 1245 Break for lunch
- 1345 Back from lunch. Drillers getting well equipment ready. Start pulling up drill rod.
- 1445 Start pumping MW07 to see if we are in bedrock aquifer 4-5 gpm. Water is milky white from crushed limestone but not muddy. Therefore, we have a good seal at the bedrock/overburden interface.
- 1450 Drillers disassembling one rear jack & gearbox at rear of rig to take back to St. Louis for repair over the weekend. Also bringing back power sprayer for repair.
- 1530 MW07 dry after pumping at 4-5 gpm for 35 min. Seems to be recovering but very slowly. Will check Monday for recovery.
- 1600 Leave site for the day.

Ray Suter 11/10/93

(74)

John Froyes 11/15/93

1230 Arrive onsite. Shaun from Layne's Aurora office is present. Shaun said the St. Louis crew should be here around 1300. I check the water level in MW07. Water is 63' from top of casing. Bottom of the well is 77' from top of casing. I instruct Shaun to start pumping water from MW07 so I could check the well's recovery. ^{SN 11/15/93} BT

1255 The well goes dry. I check the water level. Water is 76.75' below the top of casing. I set my water level indicator at 71' to check how long it takes to recover five feet. —

1400 Sonny and Pete of Layne's St. Louis office have arrived onsite. MW07 has only recharged to just below 75'. I feel that the

John Froyes 11/15/93

John Froyes 11/15/93 (75)

recharge is too slow and instruct the drillers to core and ream another 10 feet. —

1410 Drillers are replacing the hydraulic legs on the back of the rig. —

1455 Drillers are finished making repairs to the rig and set the rig over MW07 to advance the hole another 10'. —

1505 Drillers have started to trip in the core barrel and rods. —

1530 Drillers begin coring rock. I caught Pete trying to put crisco (lard) on the threads of the drill rods. I stopped him and told him they can't use any lubricants on the drill rods. —

1600 Sonny is having trouble getting circulation with the coring. The water does not seem to want to be pumped down the hole. —

John Froyes 11/15/93

(76)

John J. Royer 11/15/93

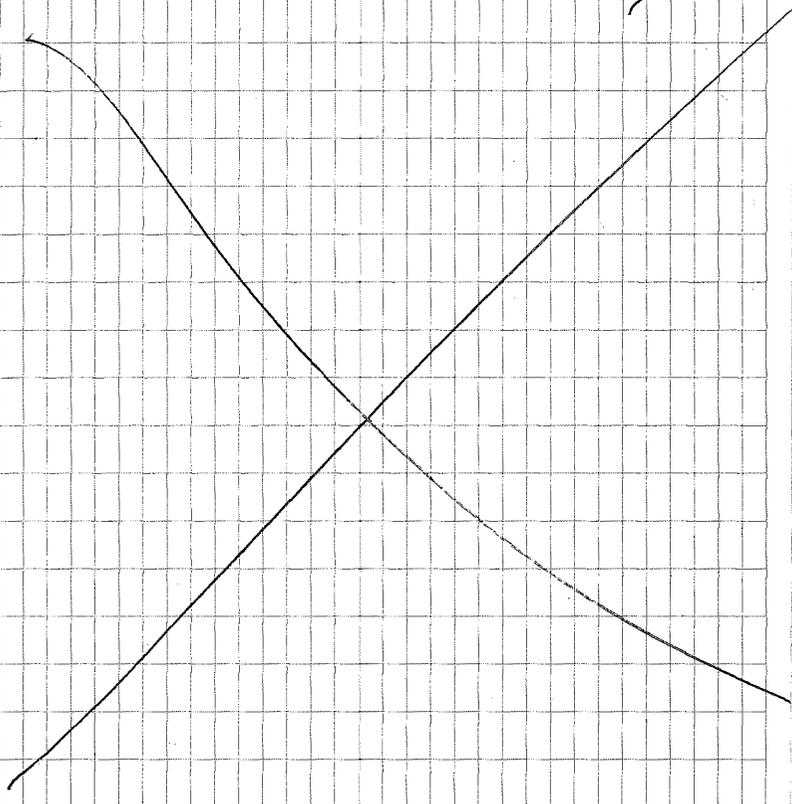
The coring is going slow.
 1610 Sonny said two things are keeping us from coring. One is a blocked water hose which one of the drillers are working on and another thing is because they are using only potable water and not drilling mud. Sonny said that there is approximately 1 foot of cuttings in the bottom of the hole from when he rollerbitted it and these cuttings are locking up the core barrel. Sonny said he could think of three solutions: one is to use drilling mud - our specs say no to this, two is to bail the cuttings out every so often - this is time consuming, three is to get a larger water ^{SN 11/15/93} pump to put the cuttings

John J. Royer 11/15/93

John J. Royer 11/15/93

(77)

up into suspension - on Bean pump. Sonny is going to call St. Louis about getting one and Shawn is going to call his Aurora office about getting one.
 1630 Leave site for day.



John J. Royer 11/15/93

(78)

John J. Reyes 11/16/93

- 0650 Arrive onsite. Drillers not yet present. Skies are overcast, temps. are in the 40's.
- 0735 Drillers arrive onsite. Shawn tells me that he and Pete are to unbad their one ton and then head over to the Aurora office to pick up a large pump - mounted on a skid. He said this pump should easily blast out the cuttings from the bottom of the hole. It will take them until after lunch before they will be back. Sonny will stay here and continue coring on MW-07.
- 0800 Drillers are leaving site to pick up water then will leave site to pick up large pump.
- 0830 Pete & Shawn leave site for Aurora office to pick up pump.
- 0845 Sonny starts up rig to begin
- John J. Reyes 11/16/93

John J. Reyes 11/16/93

(79)

- coring operations.
- 0900 Sonny is coring on MW-07. He seems to have the rig, pump, and barrels working OK without locking it in the hole. Clean, potable water from the South Chicago Heights Water Department is being used as drilling fluid.
- 0945 Have advanced the core hole approximately 4'. Have lost circulation around the outside of the standpipe, drilling water has started running offsite and into the street. Sonny stops drilling - water is used up. Sonny begins to dig out around the standpipe and plugs it with bentonite chips, digs a retention pit, and a bentonite dam to try and keep all fluids onsite. Sonny said we have to stop work until the

John J. Reyes 11/16/93

(80)

John Noyes 11/16/93

other drillers return. They took the only truck with a trailer hitch. The water tank is on a trailer. Therefore we can't get any more water till they return.

1010 Leave site for hardware store to pick up "master" locks for the wells, drillers say these are not covered in the contract

1030 Return to site and drive over to MW05 to put a lock on it.

1110 Leave site for lunch. —

1150 Return to site from lunch. Shaun and Pete are not yet present with the pump.

1330 Shaun & Pete not yet present with the pump.

1500 Sonny and I leave site to call Coyne's office and find out where Shaun and Pete are. Sonny and I both spoke with Brian B.

1530 Back at the site. Shaun & Pete are still at the Aurora

John Noyes 11/16/93

John Noyes 11/16/93 (81)

Office waiting for pump parts. Sonny says he told Pete to come right back if the pump was not ready. Brian B. said the pump would be ready tomorrow morning. I called the office and spoke with Ray Butera. Ray told me he forgot to mention that Steve M. & Scott A. approved drilling mud when Rotary reaming the boreholes - this came out of MW05 last week. —

Sonny said he'll have the helpers ready to go in the morning with or without the pump. —

1600 Leave site for day.

John Noyes 11/16/93

(82) John Noyes 11/17/93

0710 Arrive onsite. Drillers have been here for about ten minutes, Pete and Sonny are leaving site to get water so we can start coring. Shawn left site to go pick up the larger water pump at the Aurora office. Pete said it would be a few hours before Shawn would be back, the parts to fix it are to arrive this morning at the Aurora office. The temps. are in the mid 40's, it's raining, and winds are 10-20 mph.

0735 Pete and Sonny return to site with water.

0800 Drillers are pulling drill rod and core barrel up so they can repush the standpipe to get a better seat.

0810 Drillers have brought up the core barrel with approximately 3' of core.

John Noyes 11/17/93

John Noyes 11/17/93

(83)

0820 Drillers are tripping the core barrel and drill rod back into the hole for another run.

0845 Pete left site for more water, yesterday we used 200 gallons, this morning 200 gallons and Pete just left for 200 more gallons. The water does not seem to be lost to the formation but rather to the outside of the standpipe due to a bad seal - most water is running onto the site. Sonny has stopped coring till we get more water.

0900 Sonny stops coring and starts to pull the core barrel because he says it seems to be plugged up.

0910 Inside the core barrel were three one inch pieces of sch 80 PVC and floating in the mud tank were fine PVC shavings - Sonny feels

John Noyes 11/17/93

(84)

John J. Hayes 11/17/93

this may be the cause of his core barrel plugging up. He is going to pull all drill rod and see what the problem is.

0940 After pulling all drill rod it can be seen that the top 3.5' of 6" PVC has broken off in the hole - apparently the grout around the 6" annulus had settled leaving 3.5'-4" of 6" casing with no grout in the annulus which could be cause for the breakage. Sonny suggests using a coupling to piece the two pieces of 6" PVC together then I suggested we could fill the annulus with sand and or bentonite. We need to do this because if we pull out the broken off piece of 6" PVC the potentially contaminated surface soil and fill could fall into the borehole while drilling. Sonny leaves site to call shawn to bring back a coupling and I

John J. Hayes 11/17/93

John J. Hayes 11/17/93 (85)

leave site to make a call to the office.

1039 Return to site. Sonny and Pete are not yet present. The two guys in the blue pickup truck - plate no. 3291 HV were onsite taking scrap metal. I told these guys to drop what they're doing and leave the site, if they are here again I'm calling the police.

1045 Sonny and Pete arrive onsite.
1100 Sonny and Pete have a 6" PVC coupling and are to attempt to fix our casing. Sonny also said his office would like to know what sort of recovery we were interested in obtaining. I told sonny we do not have a specific volume but we are interested in enough recovery to collect our sample.

1115 Having trouble putting coupling over casing in the ground.

John J. Hayes 11/17/93

(26)

John Hayes 11/17/93

1130 Drillers cannot get the external coupling to fit over the outside of the 6" PVC casing where it broke in ^{5 11/17/93} the ground. Sonny dropped all his tape. The bottom of the hole is 76.4' below ground surface. I tell sonny to pump out the well and check well recovery. If well recovery is good we will set a well. If well recovery is not good we will need to grout in 4" steel casing to 73.5' - where the hole was reamed to 5 7/8". Then we will pull off the hole and do the other two wells. The 4" casing is needed to seal off the screened interval from any soil or fill falling into the 6" casing due to the casing being broken.

1250 Have pumped the well dry +
John Hayes 11/17/93

John Hayes 11/17/93 (27)

5 11/17/93

Bill Pete has just returned to site from with lunch. He breaks to eat and let the well recover.

1320 Water had risen 2.3' above the bottom of the well which is 76.4' below ground surface. I had the drillers pump out the water and I lowered indicator down to 2.3' above the bottom of the well and then watched and waited for recovery as the drillers looked around at MW06 + MW08 to see if their casing grouting needs topping off.

1350 It has taken 30 minutes to recover to 2.3' on MW07. I raised the water level indicator up another foot to watch recovery.

1415 It has taken 25 minutes to recover to 3.3' on MW07 (one foot above last measurement) I lifted the water level indicator
John Hayes 11/17/93

(88) John J. Noyes 11/17/93

1' to 4.5' above the bottom and will monitor how long it will take to recover this one foot.

1445 It has taken MW07 another 30 minutes to rise one foot. We pumped out the well and are going to watch it recover again. Drillers are now going to add some grout to MW08 - they just added some to MW05.

1455 Shaun arrives onsite with the larger pump.

1535 It has taken MW07 one hour to recover from 1' above the bottom of the well to 3.2' above the bottom of the well. Recovery seems to be slow but steady. I decide to tell the drillers to set the well. I will not have the drillers ream the three feet of 3" core hole we have

John J. Noyes 11/17/93

John J. Noyes 11/17/93 (89)

drilled. I will not have them ream because any benefit of this does not necessarily outweigh the time it will take to ream. There is still room for 1/2 inch sand around the bottom 3' of screen.

1625 Drillers have just finished placing the sandpack - 5 3/4 bags of sand created a filter pack from 76.5' to 64'. Drillers are now mixing up some Enviroplug grout.

1645 Drillers mixed one 50 lb bag enviroplug grout to 14 gals. of water which gave us 12' of seal - needed only 10'. ~~11/17/93~~
Drillers said before grouting the seal should set overnight.

1650 Leave site for day and call office.

John J. Noyes 11/17/93

⑨ John Royes 11/18/93

0700 Arrive onsite. Drillers not yet present. Skies are partly cloudy, temps are in the high 30's, today's highs supposedly in the 50's.

0735 Drillers arrive onsite and begin starting and warming their equipment. I check the water level in MW07. The bottom of the riser is approximately 77.0' below ground surface and the water level is approximately 62.3' below ground surface therefore approximately 15.3' of water.

0830 Just checked the depth to the bentonite, it is approximately 54' below ground surface. Drillers are now mixing up the portland cement grout.

0930 still grouting MW07.

1000 Drillers have finished grouting and placed a protective steel cover over MW07. Drillers

John Royes 11/18/93

John Royes 11/18/93 ⑨1

are breaking down equipment and preparing to decon.

1030 Drillers have deconed the rig and set it over MW08, they still need to decon all auxiliary drilling equipment and mobilize it here. Drilling at MW08 probably will not commence until after lunch.

1100 Drillers are working on getting the large-skid mounted pump back to MW08.

1145 Layne now has their pump mobilized next to their rig. We will break for lunch and make so phone calls.

1215 Return to site from lunch.

1220 Drillers return from lunch and begin moving equipment and deconing.

1330 Drillers have mobilized equipment to MW08 and are about ready to start coring.

1340 Checked the water level on MW05. Water is 44.6' below

John Royes 11/18/93

(92) John J. Noyes 11/18/93

top of casing. Drillers are now tripping in ~~drill~~SM 11/18/93 core barrel.

- 1415 Sonny starts coring. —
1515 Drillers have cored through grout and one foot of rock, to 67' and are preparing to core another 10' into rock. —
1605 Still coring. —
1615 Drillers put core barrel down to possibly having a bad bit.
1635 Part of the core bit — the bottom with the diamonds has worn away. Sonny is thinking of rollerbitting to try and breakup and bring up any steel or diamonds which could form a new core bit when put in. —
1645 Sonny said since it's getting dark all he has time to do is trip in the roller bit and drill rod. Tomorrow he will roller bit. —
1710 Leave site for day. —
John J. Noyes 11/18/93

John J. Noyes 11/19/93 (93)

- 0710 Arrive onsite, drillers have just arrived also. Skies are overcast, it's raining on and off, temps in the 40's. Sonny said he will use a large diameter drill pipe to see if he can lodge any sizeable piece of metal from the old core bit that may have fallen off. —
0750 Sonny has taken 3" diam drill rod and cut some notches in the bottom to see if he can pull up whatever cut up the last bit.
0825 Sonny brought up the drill rod which contained some chunks of chert. Sonny is still not satisfied that he will not ruin his second core bit so he decides to roller bit approximately one foot to be sure he's removed anything from the hole which could affect his core bit.
0905 Sonny has rollerbitted approximately
John J. Noyes 11/19/93

(94) John & Royes 11/19/93

two feet into the rock. He pulled out the drill rod and the few feet of rod above the bit was scratched up fairly deep. They believe this all may just be due to a lot of hard chert in the top of bedrock.

0950 Drillers had resumed coring but had to stop due to a bubble forming in their water line. Drillers are going to replace the hose with one they have on hand.

1015 I have just checked the water level on MW03 and put a master lock on the well cover. The top of water was 63.8' below top of casing, the bottom of the well is at 78.8' from top of casing. A ^{5/11/93} "V" shaped notch was placed at the top of the riser to offer a future reference point from which to measure from.

John & Royes 11/19/93

John & Royes 11/19/93 (95)

1130 Drillers have cored to 75.5'. Will core to 93' to be sure we are in water.

1220 Drillers are currently coring from 75.5' to 85.5'.

1300 Drillers finished coring to 85.5'. Drillers begin coring another 5'.

1345 Drillers finished coring to 90.5'. Drillers are working on pulling the core rod out of the hole.

1400 Break for lunch.

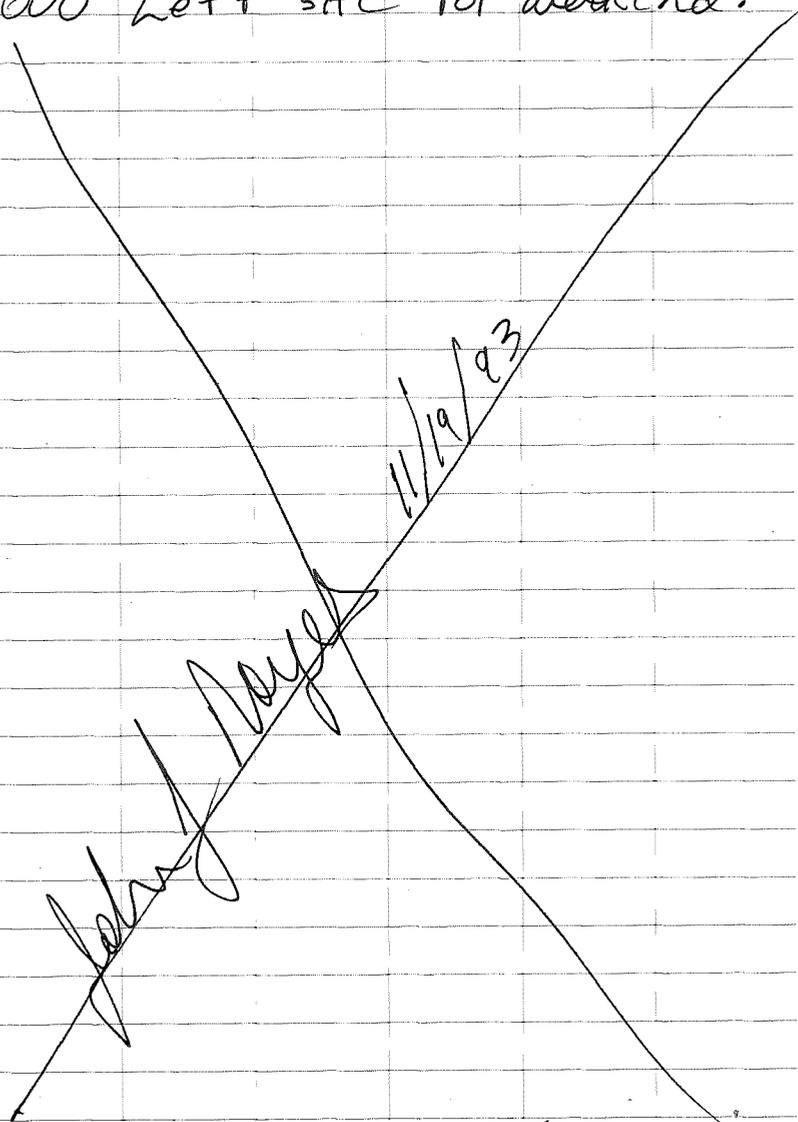
1500 Return to site from lunch and calling office. Drillers are present.

1530 Drillers have all drill rod pulled out of the hole. I ask Sonny to pump the water down and Sonny told me that Shaun did not bring the pump today, he did not think we would need it. So, drillers are breaking down some equipment and are preparing to leave site for the

John & Royes 11/19/93

(96) John J. Noyes 11/19/93

weekend. _____
1600 Left site For weekend.



John J. Noyes 11/19/93

John J. Noyes 11/22/93 (97)

0705 Arrive on site. Drillers not present. Skies are clear and sunny, highs today in the 50's, currently 38.

0730 Shaun From Layne's Aurora office arrives onsite. Shaun said as far as he knew Sonny and Pete should have been here.

0745 Shaun is starting up the drill rig and preparing to trip the drill rod down the hole.

0840 Shaun has tripped in the 3 7/8" tricone bit, 55' of drill rod and is preparing the high powered pump. Shaun said he can't start drilling because he needs three people, one to watch the pump. Sonny and Pete are not yet here. I leave site to call office.

0900 Shaun has left site to get water

John J. Noyes 11/22/93

(98) John J. Noyes 11/22/93

I have returned to site from calling office. Sonny and Pete are not yet present. —

0935 Eric from St. Louis arrives onsite. Eric said Pete is having a tooth pulled and Sonny's brother in law passed away. Shaun arrives back with water. —

1000 Drillers have large pump warming up and are ready to begin reaming rock. —

1100 Drillers have reamed MW08 to 70' but had to stop to pick up more water and gas for the rig and mud pump. —

Mud pump is working great. 1150 Drillers return to site with water and gas. —

1330 Reaming is slow, we are down to 75', 15' to go. Drillers break for lunch and water. —

1410 Return to site. Drillers not yet back from lunch. —

1430 Drillers arrive back at the site. —

John J. Noyes 11/22/93

John J. Noyes 11/22/93 (99)

1530 Drilling is slow due to very hard rock, a good amount of chert exists in the top part of the limestone. Right now the hole has been reamed to 78' ^{17 1/2"}, 10' of reaming to go. —

1610 Drillers have reamed the hole to 80'. Drillers have to stop here and drain their pump and water lines due to freezing temperatures overnight. —

1630 Drillers are draining the water from the mud pump. —

1640 Leave site for day. —

~~John J. Noyes 11/22/93~~

(100) John F. Noyes 11/23/93

0650 Arrive onsite. ERIC From Layne is present. Temps. are in the 40's, skies are overcast.

0730 Shaun From Layne arrives onsite. Drillers begin prepping drilling equipment.

0830 Reaming bedrock on MW08.

0930 Have reamed to 85' on MW08 and advancing the hole the last 5' to 90'.

1050 The hole has been reamed to 90' and Flushed with clean water. Drillers are now working on tripping out the drill rods so we can insert the well in the hole and pump out the water to watch recovery and determine if we are in water.

1200 Break for lunch. Bottom of the hole is 89.9'. Drillers have all drill rod out of the hole. We will check the water after lunch.

1310 Drillers return to site from lunch, gas, & water.

John F. Noyes 11/23/93

John F. Noyes 11/23/93 (101)

1530 Have pumped the well dry twice and watched it recover approximately one foot per ten minutes. Drillers are now setting a well.

1550 Drillers have sandpacked the well from 89.9' to 78' and are now tremieing in the enviroplog grout from 78' to 54'. The bottom of the casing is at 55'.

1600 Drillers are deconing equipment and mobilizing it to the decon pad.

1620 Leave site for day. Drillers are moving the rig over to MW06.

John F. Noyes 11/23/93

(102)

John J. Noyes 11/24/93

0710 Arrive onsite. Eric from
Layne is present. Eric said
while moving the rig over
to MW06 and dragging the
mud pump the seals on the
front steering system - hydraulic
system broke. The rig is
almost over MW06, it is
down in the ravine but
about 30' away. Eric is
going to look at the seals
this morning to be sure that's
what the problem is.

0750 Eric has removed the hydraulic
cylinder for the rig's front end.
A seal has "blown". Eric
leaves site to call his shop's
mechanic about what to do
as far as fixing the seal
goes.

0915 Eric has not yet returned
to the site and Shaun from
the Aurora office has not
shown up yet.

0925 Eric returns to site. He will

John J. Noyes 11/24/93

John J. Noyes

11/24/93

(103)

not be able to get parts
until later today or Monday.
Eric decides to begin grouting
on MW08.

1045 Eric and I are grouting
MW08. Shaun from the
Aurora has not yet shown
up on site.

1100 Finish grouting MW08. Eric
calls about power steering cylinder.
I call office. Shaun arrives onsite.

1140 Eric is leaving site to take
the cylinder to another shop
which can fix it. Shaun and
I break for lunch and to
pick up some Nylon rope so we
can develop the wells after
lunch.

1220 Return to site. Drillers not
present.

1330 Neither Eric or Shaun have
returned to site from lunch.

1335 Eric and Shaun arrive onsite
from lunch and hopefully getting
the cylinder fixed.

John J. Noyes 11/24/93

(104)

John J. Noyes 11/24/93

1340 Eric said that a mechanic picked up the cylinder and had to take it to Highland, Ind. and would be ready to go first thing Monday morning. Eric then said he was going to pick up a few things around the site and then go home. I told Eric and Shaun nothing around the site needed to be picked up and that we need to start surging and purging the wells. Eric and Shaun then decided to go get water and do some deconing.

1440 Drillers have deconed some equipment; hoses & drill rods. I have called office and spoke with Steve Mrkvicka. Eric has left site to get water line antifreeze.

1500 Eric leaves site for St. Louis. Shaun also leaves site for holiday weekend as do I.

John J. Noyes 11/24/93

John J. Noyes 11/29/93 (105)

0650 Arrive onsite. Drillers not present. Skies are overcast, temps in the high 20's to low 30's, light snow cover on the ground.

0715 Shaun from Layne's Aurora office arrives onsite, also a Layne rep. has arrived onsite with the new cylinder and hydraulic fluid for the drill rig. Shaun takes the cylinder and hydraulic fluid down to the rig and begin working on it.

0740 Shaun has installed the hydraulic cylinder on the rig but is leaving the site to call his office. He said we will start the rig up when he returns.

0800 Shaun returns to site and prepares to set rig over MW06.

0830 Rig and pump are over MW06. Eric has arrived from St. Louis, but without a second man.

John J. Noyes 11/29/93

(106)

John J. Noyes 11/29/93

Drillers are trying to start up their two ton so they can get water. We cannot start drilling until they pickup water.

0915 Drillers leave site to call office. The two ton's batteries are dead and one blew a post.

0945 Drillers return to site. Another nearby Layne rep. is to come by and fix their two ton. Meanwhile the drillers have decided to use the rig to drag their two ton down the hill and over to the location of MW06.

1040 The two ton is at the base of the slope, the rig is over the hole, Eric left site to pickup water, and Hymie - a Layne employee has arrived onsite.

1150 Eric has returned with one load of water, but several more are needed before drilling can begin.

John J. Noyes 11/29/93

John J. Noyes 11/29/93 (107)

We break for lunch while they are getting water. I call office.

1240 Return to site from lunch, drillers not present.

1315 Drillers arrive back at site.

1330 Begin coring.

1350 Core barrel has just cored through the grout from the previous 6" casing and into a leaching sand at 33'. The sands will leave as much as five feet to ten feet. This explains why when the 6" casing was pushed only to 25' and not 30'. I stop drilling and call office to inform Steve of the situation. I inform Steve that the drillers could use mud and a 5 7/8" tricone through the 6" casing to bedrock, then set and grout 4" steel casing to rock, sealing off

John J. Noyes 11/29/93

(108) John J. Noyes 11/29/93

- the sands and any other unconsolidated material not already sealed off by the 6" casing. Steve liked the idea and wanted to run it by Scott.
- 1420 Steve called back and said Scott ok'd it. I inform the drillers to start reaming w/5 7/8" frac and mud.
- 1520 Drillers are about through mixing the mud but will not begin drilling tonight because of several reasons: the large mud pump needs to be warmed up and then primed which takes awhile, the pump and all hoses will have to be drained because of below freezing temperatures overnight, and daylight is lost about 1630. Drillers said they will be ready to go first thing in the morning. Meanwhile they are preping things for tomorrow.
- 1600 Leave site for day, drillers, & I.

John J. Noyes 11/29/93

John J. Noyes 11/30/93 (109)

- 0645 Arrive onsite, Eric from Layne is present. Skie are overcast, temps. are in the 30's.
- 0715 Shaun and Hymie have arrived onsite. All go over to rig and equipment and start warming things up.
- 0830 Have not yet drilled past 35'; have encountered a lot of gravel and cobbles which are slowing the drilling down. Currently the mud pump is not working correctly and the drillers are working on it. Eric was supposed to have gone to get water.
- 0920 Drillers are still working on the mud pump. Eric is preparing to start developing the other three wells which are finished.
- 1010 Shaun tells me he can't keep his mud pump primed and decides to call his office.

John J. Noyes 11/30/93

① ①① John J. Noyes 11/30/93

1045 Drillers still having trouble with their mud pump so I go to watch Eric develop MWO7.

1130 A mechanic from Layne has arrived onsite to work on the mud pumps and apparently the rig isn't quite working right. Eric is developing MWO7. I call the office.

1215 Leave site for lunch.

1250 ~~Leave site~~ Arrive back at site. Drillers are gone to lunch.

1350 Drillers return to site.

1400 Shaun said the mechanic determined that gravel was getting into the pump's cylinders and causing it to lose pressure. So, while at lunch they bought some wood and screen to build walls in the mud tank to keep the gravel settled out before reaching the suction hose.

1500 Called the office and spoke with John J. Noyes 11/30/93

John J. Noyes 11/30/93 ①①①

Steve Mrkvicka. 1550 The main mud hose from the mud pump to the drill rod split in the middle. Shaun is going to try and repair it.

1630 Have reached bedrock at approximately 37'. Shaun is going to try and drill at least one foot into it to set the 4" casing.

1650 Everyone leaves site for day.

~~John J. Noyes 11/30/93~~

John J. Noyes 11/30/93

(112) John A. Hayes 12/1/93

0715 Arrive on site. Drillers are not present. Temp's in the 30's, skies are partly cloudy.

0720 Hymie arrives onsite and says him and Eric were here at 0700 but left to make a phone call.

0730 Eric arrives onsite and looks up trailer to pick up water.

0735 Shawn arrives onsite.

0840 Drillers are filling their mud tank and putting a new bit on their drill rod, the other tricone was getting dull.

0950 Drillers have drilled approximately 2' into bedrock and are flushing the hole with extra thick mud to hold the hole open while they trip in the 4" steel casing.

1000 Two men have driven onto the site, they gave me a business card, name of one man is

Steve Happ the other's last name is Grafrath. They said they own "Happ's, Inc." and

John A. Hayes 12/1/93

John A. Hayes 12/1/93 (113)

used to be a contractor for Lobue. They would come out here and reclaim scrap metal. They said they are out here today looking over scrap metal to recycle beginning this new year, Jan. 1.

1030 Drillers have tripped in 33' of 4" carbon steel casing but it stopped approximately 3' short. I have the drillers bail out the cuttings which they are working on now and will also have them lift up the casing and drop in a six bag batch of grout to be sure of a good seal in addition to tremie grouting the outside of the casing.

1145 Drillers are still bailing MWOG. The cuttings are coming out of the hole.

1230 Break for lunch. Casing is ready to be grouted in after lunch.

John A. Hayes 12/1/93

(114)

John J. Royes 12/1/93

- 1315 Return to site From lunch, Drillers not yet present.
- 1330 Drillers arrive onsite From lunch.
- 1415 Drillers are grouting in 4" casing on MW06. Eric and I begin development on MW05.
- 1540 Drillers have grouted in the 4" on MW06 & Eric and I just finished three half hour sets of surging and pumping on MW05. The water clears up nicely but has a sulfur smell.
- 1630 Eric and I just pumped + surged MW08 for 40 minutes. MW08 has slow recovery.
- 1640 Leave site for day.

~~John J. Royes 12/1/93~~

John J. Royes 12/2/93

(115)

- 0700 Arrive onsite, Eric & from Layne is present. Skies are overcast and its raining lightly, temps in the mid 40's.
- 0745 Eric left site to pick up water. Shaun and Hymie have not yet shown up.
- 0800 Shaun arrives onsite, Eric returns with the water.
- 0820 Shaun and Eric are preparing to core on MW06.
- 0830 Eric had to leave site to pick up gasoline for the rig. Shaun says the 4" casing has been set 2' into rock at 33'.
- 0900 Eric returns with the gasoline and coring continues.
- 0945 Drillers cored through 8' of grout and .5' of rock, with .5' of core recovery, core hole is at 33.5'.
- 1020 Cored from 33.5' to 35'. Have 1.5' of rock core recovery. Eric is off developing MW07 & MW08.
- 1100 Cored from 35' to 37.5', 2.5'

John J. Royes 12/2/93

(116)

John Noyes 12/2/93

of core recovery. Core is highly fractured, will probably produce a good amount of water.

1220 Drillers have cored to 45' with 75' of core recovery on MW06. We are going to break for lunch.

1230 Leave site for lunch.

1330 Return to site from lunch and calling office. Shaun and Hymie are tripping out the core barrel on MW06 and preparing to ream. Eric went to his hotel to pick up the sub for the tricone bit used to ream. The sub was sent overnight from St. Louis.

1440 Drillers are reaming MW06 and I check on Eric developing MW08.

1450 Eric has developed a total of 28 gallons from MW08, the water is clear but has a very strong sulphur odor. We now head over

John Noyes 12/2/93

John Noyes 12/2/93

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to MW07.

1515 MW07 is still producing muddy water, brown in color. Eric said he bailed four gallons earlier and we have just pumped dry three times with less than 5 gals. of recovery.

1540 Shan has just finished reaming MW06 from 30.5' to ~45.2' with a 3 7/8" tricone bit using potable water as drilling fluid. Drillers are now pulling the drill rod so we can drop in the well and then a pump to see if we have water recovery.

1555 The total depth on MW06 is 49.2'. We decided to put about 4' of sand in the hole so we are screened from 45.2' to 35.2'. Most of the water producing fractures were in the 30' range.

1605 Have started pumping MW06.

1645 Have pumped MW06 dry two

John Noyes 12/2/93

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John Noyes 12/2/93

times and it takes approx.

16-20 minutes to recover

Five Feet. I am having

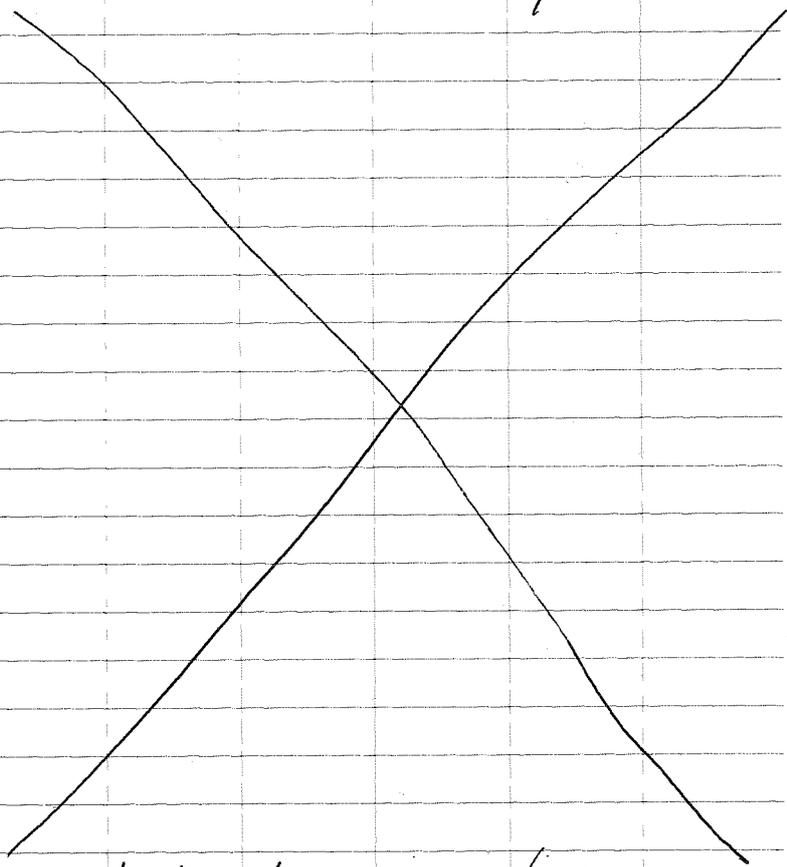
the drillers pump it down

a third time to be sure

we are in water. ———

0500

Leave site for day. ———



John Noyes 12/2/93

John Noyes 12/3/93 (119)

0650 Arrive onsite, Eric from
Layne is here. ———0720 Eric and I go to pump down
MW06 one more time to determine
if we have water. ———

0730 There is a 14' column of water
in the well, from 47' to
33'. This column of water
is the same height found in
the other wells MW-7 &
MW-8. We have pumped the
water out and are watching
it recover from 47' to
43', last night it took
from 16-20 minutes to recover
4'. Also, after the sand
pack is set on this well instead
of using the enviroplug bentonite
grout which needs to set up
over night before cementing
on top of that we are going to
use enviroplug bentonite chips for
the well seal above the sand pack.
The chips do not need to set up
overnight, cement can be put on

John Noyes 12/3/93

(20) John Hayes 12/3/93

- top as soon as chips have been hydrated.
- 0815 It has taken 14 minutes for the well to recover 4 feet. We decide to set the well, correction I decide to set a well and the drillers begin gravel packing.
- 0915 Drillers have added too much sand and instead of ~~5~~ 12' sand pack there is ^{16' 5" 12/3/93} 16' of sand. Sand is from 47' to 31', and bentonite chips from 31' to 28'. Drillers are preparing to mix up the grout for the rest of the way, Eric leaves site to pick up water.
- 0950 Drillers have used their rig to drag the mud pump to the decon area and went back to use the rig to pull out the two ton truck.
- 1030 Hymie has returned to site with the backhoe to dig a pad for the well covers and post
- John Hayes 12/3/93

John Hayes 12/3/93 (21)

- holes. The rig has gotten stuck pulling out the 2 ton so their using the hoe to try and unstick both of them.
- 1205 Hymie has backhoed around MW08 & MW07 and is currently working on MW06. Guard posts and cement have not yet been installed.
- 1230 Called office and spoke with Steve Mrkvicka.
- 1330 Drillers finish padding and posting MW06. Drillers are working on padding & cementing MW07 and MW08. Eric left site to pick up some water.
- 1515 Eric has just finished cementing the pad and posts on MW07. Pete and Sonny have arrived onsite from St. Louis with a hobo to mobilize the rig home.
- 1520 Drillers are deconing equipment on pad.
- John Hayes 12/3/93

(122) John Royes 12/3/93

1640 Have arranged a meeting with Miguel so he can pick up this truck because he was coming out here tomorrow. Drillers are loading and decorating equipment. —

1700 Leave site for day. —

~~John Royes 12/3/93~~

John Royes 12/3/93

Saturday, December 04, 1993 (123)

0700 Arrive at the LoBue #2 site. Layne drillers are not here yet. I open the gate and enter the site.

Layne should be finishing their work and demobilizing from the site today. —

0715 Weather check: Raining, cold, Temp. ~41°F, light winds, out of N.

0725 Two Layne workers, Sonny and Eric, arrive onsite. A tow truck had to bring them. Sonny informs me that their truck (2-ton) would not start this morning. He says he'll be a little late getting going this morning because he will have to detach the low-boy from the trailer to use the trailer to go get the two-ton truck. Eric (Layne) says they will finish developing MW-07, place sand in the annulus of MW-06, drill a vent hole in MW-06, decor equipment, and demob today. —

0740 Layne workers leave the site in their trailer to go get their

Miguel A. Sanchez

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12/04/93

two-ton truck. _____

0840 Layne workers, Sonny and Eric, are back onsite w/ their two-ton truck and trailer.

Sonny will work on hooking the low-boy back onto the trailer. Eric will ^{use} ~~use~~ ^{m.d. 12/4/93} set up the generator to use a submersible pump to pump water out of MW07 for development.

The pump is already in the well.

0855 Approx. 1/2 gal. pumped out of MW07. Water went from very turbid to clear. Well pumped dry. Eric (Layne) will let the well recharge and pump it dry again. Sonny (Layne) still working on hooking up low-boy to trailer.

0900 Eric (Layne) leaves the site to go to the hardware store to buy a mirror for the two-ton truck. —

0930 Eric (Layne) is back onsite. He turns the pump in MW-07 on. The well is pumped dry. Approx. 1/2 gal. pumped out.

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The water went from slightly turbid to very turbid back to slightly turbid. _____

0935 Eric drills vent hole near top of 2" PVC riser pipe ^{at MW07 m.d. 12/4/93} using a hand held manual drill. He has a little trouble doing it because the outer protective steel casing ^{m.d. 12/4/93} ~~is~~ extends up past the riser pipe. —

0950 At MW-06. Eric drills vent hole on the side of the 2" PVC riser pipe, near the top. Then he drops ~1 1/2 bags of sand in the annulus between the riser pipe and the outer protective casing. Note that the cap on the riser pipe does not tighten because of the threads at the top of the riser pipe (i.e. threads make the PVC riser pipe have a slightly bigger inside diameter so ^{m.d. 12/4/93} ~~cap~~ pressure cap can't grasp it. Eric puts a strip of cloth from his handkerchief around the cap to take up the space. —

1005 At MW-08. Eric has trouble getting

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to the side of the PVC riser pipe because the outer protective casing extends up above the riser pipe. Eric decides to drill through the side of the outer protective casing to drill the vent hole in the riser pipe. _____

1015 Vent hole for MW08 completed. Eric now drops ~1 1/2 bags of sand in annulus between riser pipe and outer protective casing.

1017 Well MW08 is capped and locked. Head back to MW07. _____

1020 Eric pumps MW07 dry in a matter of seconds. ~1/2 gal. of water pumped. The water goes from slightly turbid to very turbid back to slightly turbid. Eric says the pump is sitting at the bottom of the well. He now surges the well w/ the sub. pump. _____

1030 Note that Sonny has been working on loading equipment
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onto the low-boy, underneath the ATV drill rig, all this time. Also, note that the rain has stopped. _____

1035 Well MW07 pumped dry once again. Same process as earlier today. Water was turbid. _____

1036 Pete, ^{m.d. 12/4/93} ~~and~~ who is another Layne worker, arrives ^{onsite m.d. 12/4/93} ~~onsite~~ in a one-ton truck. He will help with the deconing of equipment and demob. _____

1050 Well MW07 pumped dry once again. ~1/4 gal pumped. Water was turbid. Also Pete leaves the site. Eric will set up to decon equipment. _____

1105 Pete is back onsite. The ^{municipal water supply} ~~store~~ he ^{m.d. 12/4/93} went to was closed. Eric turns pump in MW07 on. The well is pumped dry. ~1/2 gal. pumped. The water was turbid, milky. _____

1110 Pete and Eric (Layne) are ^{m.d.} ~~now~~ jacking up the small trailer w/ the high pressure washer to the back of the one-ton truck. Sonny is getting ready to leave w/ the low-boy. _____

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1120 Sonny (Layne) leaves the site. He is driving the low-boy, loaded w/ the ATV rig and some equip, back to St. Louis, Missouri. Also; Eric turns pump ⁱⁿ ~~off~~ MW07 ^{12/4/93} on. Well pumped dry. ~1/2 gal. pumped.

There is a section of the water that comes out very turbid. Other sections are slightly turbid. —

1125 Pete leaves the site, taking the trailer-mounted high pressure washer, attached to the back of the 1-ton truck, with him. Eric working on loading the two-ton truck. —

1130 Eric informs me that Pete went to go get water for deconing from a gas station. The municipal water department station where they usually get their water from is closed. —

1135 Eric pumps MW07 dry again. ~1/2 gal pumped. Water still turning very turbid before becoming milky and the clearing up to slightly turbid. —

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1150 Well MW-07 pumped dry again. Still some turbidity to the water. ~1/2 gal. pumped. —

1155 Pete arrives back onsite. —

1205 Well MW-07 pumped dry once again: ~1/2 gal. pumped, the water still turns turbid before starting to clear up as it is pumped. I make the decision to discontinue pumping the well and consider it developed. —

1207 Eric and Pete will now finish deconing and picking up their equipment. A total of ~5 gal. were pumped from MW07 today. —

1215 Eric and Pete are deconing the 2-ton truck. —

1230 Pete is deconing 1-ton truck and the trailer mounted steam cleaner. —

1245 Eric has removed the pump from MW07 and has placed ~3 bags of sand in annulus between the PVC riser pipe and the outer protective casing. —

1305 Layne has finished loading their equipment onto their trucks, and

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have picked up debris around the decon area. They now leave the site. Layne's work here onsite is finished. —

1315 I lock the front gate and leave the site. BUWST will return on Monday 12/06/93 to develop MW06 and purge and sample the monitoring wells.

Miguel R. Sanchez
12/04/93

1-7-94 *M. J. Talley*

0715 Arrived onsite. Present see:
John Noyes and Mitch Bulak. Weather is: Sky is overcast, temp is 15°C, stray breeze from the south. John and Mitch will be running a bench mark (elevation) to all the wells onsite. We will be using ~~the~~ relative elevations between the wells.

<u>O.S.</u>	<u>F.S.</u>	<u>H.I.</u>	<u>Elev(ft)</u>	<u>Notes</u>
13.98		413.98	400.00 (assumed)	MW-6
	16.66			Ground
	1.30		412.68	TP A
6.06		418.74		BS on TPA
	3.52		415.22	MW-7
	5.50		413.24	Ground
	4.54		414.20	TP B
3.76		417.96		BS on B
	10.96		407.00	MW-5
	12.36		405.60	Ground
4.76		419.98		BS on MW7
	5.48		414.50	MW-8
	7.98		412.00	Ground

1-7-94 *M. J. Talley*

John J. Royes 1-7-94

1000 At MW-5, Mitch and John prepare to perform three consecutive slug tests.

MW-5, Test #0, water level below TOC is 44.41 Feet, to bottom of well 62.80 Feet.

1105. At MW-6, prepare to perform three consecutive slug tests. Test #1 was conducted at MW-5, as was Test #2 though Test #2 experienced operator error. Begin Test #'s 3, 4, 5 at MW-6. Depth to water level below TOC is 33.25 Feet to bottom of well 50.41 Feet.

1240 Leave site for lunch.

1315 At MW-8, preparing to conduct slug testing. Test #'s at MW-8 are #6, 7, 8. Depth to water below TOC is 70.92 Feet to bottom of well 93.06 Feet.

1430 At MW-7, preparing to perform slug testing.

John J. Royes 1-7-94

John J. Royes 1-7-94

Test #'s at MW-7 are 9, 10, 11. Depth to water below TOC at MW-7 is 62.62 Feet, to bottom of well is 78.30 Feet.

1610 Finish testing at MW-7 and leave site for day.

~~John J. Royes 1-7-94~~

John J. Royes 1-7-94

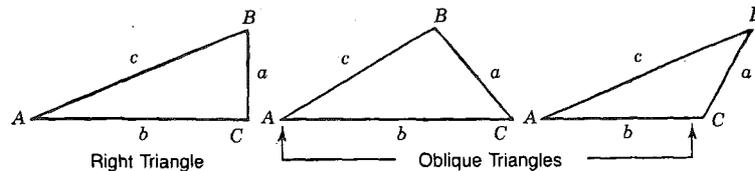
miguel Sanchez
 (708) 652-4125

Warelowe
 594-1038

Slight slope
 to S.W. 1 moist,
 fill underfoot

~~312-5941-1038~~

TRIGONOMETRIC FORMULÆ



Solution of Right Triangles

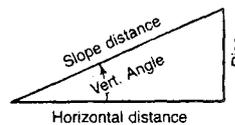
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	Formulas
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B$, $c = \sqrt{a^2 + b^2} = a \sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B$, $b = \sqrt{(c+a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90^\circ - A$, $b = a \cot A$, $c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90^\circ - A$, $a = b \tan A$, $c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90^\circ - A$, $a = c \sin A$, $b = c \cos A$

Solution of Oblique Triangles

A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A}$, $C = 180^\circ - (A+B)$, $c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}$, $C = 180^\circ - (A+B)$, $c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A+B = 180^\circ - C$, $\tan \frac{1}{2}(A-B) = \frac{(a-b) \tan \frac{1}{2}(A+B)}{a+b}$ $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2}$, $\sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}$ $\sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}}$, $C = 180^\circ - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2}$, $\text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = $5^\circ 10'$. From Table, Page IX. $\cos 5^\circ 10' = .9959$. Horizontal distance = $319.4 \times .9959 = 318.09$ ft.
 Horizontal distance also = Slope distance minus slope distance times (1 - cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. $\cos 5^\circ 10' = .9959$. $1 - .9959 = .0041$. $319.4 \times .0041 = 1.31$. $319.4 - 1.31 = 318.09$ ft.

When the rise is known, the horizontal distance is approximately: - the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance = $302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.